Routledge
Taylor & Francis Group

Ethics, Policy & Environment

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/cepe21

Beyond 'Native V. Alien': Critiques of the Native/alien Paradigm in the Anthropocene, and Their Implications

Charles R. Warren

To cite this article: Charles R. Warren (2021): Beyond 'Native V. Alien': Critiques of the Native/alien Paradigm in the Anthropocene, and Their Implications, Ethics, Policy & Environment, DOI: 10.1080/21550085.2021.1961200

To link to this article: https://doi.org/10.1080/21550085.2021.1961200

Published online: 12 Aug 2021.

ETHICS, POLICY & ENVIRONMENT
https://doi.org/10.1080/21550085.2021.1961200

Routledge
Taylor & Francis Group

Beyond 'Native V. Alien': Critiques of the Native/alien Paradigm in the Anthropocene, and Their Implications

Charles R. Warren

School of Geography and Sustainable Development, University of St Andrews, Scotland, UK

ABSTRACT

Classifying species as 'native' or 'alien' carries prescriptive force in the valuation and management of 'nature'. But the classification itself and its application are contested, raising philosophical and geographical questions about place, space, rights, identity and belonging. This paper discusses leading critiques of the native/alien paradigm, including its conceptual fluidity, dichotomous rigidity and ethical difficulties, as well as the incendiary charge of xenophobia. It argues that valorizing 'native nature' as inherently the 'best nature' is not only obsolete but impracticable in the Anthropocene, and that the preeminence of biogeographic origins should be replaced with a pragmatic focus on species' behavior.

KEYWORDS

Alien; native; species; invasion; nature

Introduction: Biogeographies of Belonging and Exclusion

Classifying species as either native or alien is central to nature conservation practice, with natives cherished and aliens resisted, but both the distinction itself and policy prescriptions based on it have been extensively critiqued. This paper explores the fractious, longstanding debates between those who champion 'native nature' and those who advocate a more inclusive, cosmopolitan approach (Keulartz & van der Weele, 2009; Stanescu, 2017), one which embraces new arrivals and the novel assemblages of the Anthropocene. It adopts a geographical lens because distinguishing between native and alien species is an essentially geographical categorization, hinging on questions of scale, place, space, culture and environment which lie at the heart of geography (Antonsich, 2020; Warren, 2007). The distinction creates geographies of spatial inclusion and exclusion, defining where species belong (Cresswell, 1997). Curiously, given that such geographical questions are central to native/alien debates and that the arguments turn on questions of spatial and temporal scale, geographers – with relatively few exceptions (notably Head (2012, 2014, 2017)) – have only engaged sporadically.

By contrast, environmental philosophers have developed a rich and nuanced seam of discussion of the contested ethics and values concerning native and alien species (e.g. Futhazar, 2020; Hattingh, 2001; Hettinger, 2001, 2021; O'Brien, 2006; Peretti, 1998; Sagoff, 1999, 2005, 2013; Stanescu & Cummings, 2017a; Vogel, 2016; Woods & Moriarty, 2001). The vocabulary itself raises ethical dilemmas because, as explored below, the language

CONTACT Charles R. Warren crw2@st-andrews.ac.uk School of Geography and Sustainable Development, University of St Andrews, Fife, Scotland KY16 9AL, UK

employed in determining where species belong relies on troubling definitions and terminologies (Schmitt, 2017; Stanescu & Cummings, 2017b). A key contribution of environmental philosophers has been to parse the critical questions of value (Stanescu & Cummings, 2017b). Because of the multiple, competing values and difficult moral dilemmas surrounding native and alien species, Woods and Moriarty speculated in 2001 that they may always be the focus of fraught debate. Two decades on, the discourses remain as passionate as ever – unsurprising, perhaps, given that they sit at the intersection of conservation science, ethics, values, public policy and social perception.

From descriptive origins, the native/alien species distinction has evolved into a prescriptive, normative paradigm, differentiating desirable from undesirable nature. It has axiomatic status in nature conservation and, in Western cultures, is a dominant lens through which nature is viewed and valued. However, this framing has been disputed with increasing frequency and ferocity in recent decades as it has become apparent that 'the question of what is native and what is alien is riddled with paradox and puzzle' (Smout, 2014, p. 12). Early critiques of the native/alien classification (hereafter NAC) came predominantly from environmental philosophers and social scientists while criticisms by ecologists came later.[1] At root, the disputes are animated by contrasting worldviews concerning what nature is or should be (Simberloff, 2012, 2015), views which span the spectrum from nativism to cosmopolitanism (Keulartz & van der Weele, 2009; Switzer & Angeli, 2016).

Precise definitions of 'native' and 'alien' are elusive, as discussed below, but as commonly understood, native species are those that evolved in an area or colonized it naturally, whereas alien species are those that have been introduced beyond their natural range by humans, intentionally or otherwise. Native animals and plants are seen as 'belonging' in an area, alien ones as out of place, sometimes disruptively.[2] 'Invasive' describes those species – alien or native – which expand their range vigorously, outcompeting others. As a consequence of the largescale translocation of animals and plants through global trade, travel and tourism, introduced species are increasing exponentially and dominating many landscapes, resulting in the dissolution of ancient biogeographical boundaries (Hulme, 2015; Keller et al., 2015).

Concerns about the spread of alien species are commonly traced to Charles Elton's 1958 book *The Ecology of Invasions by Animals and Plants*, and the subsequent inception of invasion biology. Whereas Elton himself saw a place for 'exotic forms', most ecologists today regard all aliens as inherently undesirable (Humair et al., 2014; Simberloff, 2012; Young & Larson, 2011). Their unnaturalness renders them unwelcome in principle (Hettinger, 2021) such that their presence is used as an indicator of ecosystem degradation (Guerin et al., 2018; Heink et al., 2018). They constitute 'bad biodiversity' (Prévot-Julliard et al., 2011), 'biological pollution' (Guiasu, 2016), 'ecological tumours' (G. Hamilton, 2011), 'unwanted nature' (Qvenild, 2014). Indeed, definitions and indices of biodiversity and ecosystem integrity often explicitly exclude alien species, *a priori* (Gbedomon et al., 2020; Schlaepfer, 2018a), such that their presence is damaging by definition, regardless of their effects (Boltovskoy et al., 2018; Sagoff, 2005, 2018a). This overwhelmingly negative view derives from the fact that a small minority of alien species become invasive and have sufficiently significant impacts that they are regarded as a primary threat to global biodiversity, economies and human health (Early et al., 2016; Pimentel, 2011). Such invasions are now widely seen as 'an unrelenting environmental and economic calamity' (Meyerson et al., 2019, p. 191). Numerous

examples are documented by Simberloff (2013) and Anthony (2017), and vast expenditure and effort is invested in campaigns to counteract their multifaceted, damaging consequences (Diagne et al., 2021). The numerous policies designed to prevent, eradicate or control alien species, and to preserve native biodiversity, enshrine in law the view that natives are beneficial whereas aliens are actually or potentially harmful.

Criticisms of the NAC and its application have multiplied in the last two decades as both social and natural scientists and philosophers have challenged the dichotomous framing and normative prescriptions of invasion biology (Inglis, 2020; Rotherham & Lambert, 2011; Thomas, 2017), generating a steady stream of sharp public exchanges.[3] This paper discusses the key bones of contention, focusing first on critiques of the NAC itself and then on its application, drawing on the scientific and philosophical literature. Following a brief summary of 'the case for the defense', the discussion then explores ways of reframing this polarized debate, and the implications of the Anthropocene for the NAC. It asks whether the price – literally and figuratively – of the purist pursuit of 'native nature' is worth paying, or whether, in the context of an anthropogenically transformed world, valorizing 'cosmopolitan nature' would be more justifiable, coherent, practicable and beneficial.

'Native' and 'Alien' in The Dock

Critiques of the Native/alien Paradigm

Elusive Definitions

Although the terms 'native' and 'alien' are intuitively obvious, precise definitions are elusive (Crees & Turvey, 2015; Essl et al., 2018; Gilroy et al., 2017). Although often employed as discrete, binary categories, the terms are better understood as cluster concepts which represent the endpoints of a continuum along which many complex entanglements exist (Knights, 2008; Macdonald et al., 2007; Woods & Moriarty, 2001). Rigorous definition is undermined by the essentially relative nature of the labels, both in time and space, because they do not describe innate biological characteristics but geohistories and mechanisms of dispersal. The terms are relational, not describing species as such but populations of species deemed to be in the right or wrong place (Fall, 2014a; Van Dooren, 2011). Differentiating between native and alien assemblages of species is not possible using objective, ahistorical criteria (Peretti, 1998; Poe & Latella, 2018). Consequently, no species is intrinsically alien or native but only in relation to a particular area at a particular time, such that the spatial and temporal boundaries of that space can be – and are – constructed in many different ways (Boonman-Berson et al., 2014; Humair et al., 2014; Warren, 2007). In particular, the temporal threshold of nativeness varies widely between nations, with the date of European colonization often selected as a convenient but arbitrary 'year zero' (Head, 2012, 2017; Qvenild, 2014). Choices about spatiotemporal scale critically affect the NAC (Boonman-Berson et al., 2014), yet scale is socially constructed, not naturally given (Linnell, 2015; Marston, 2000). The native/alien paradigm is thus 'not purely dependent on objective ecological criteria, but on the kind of time–space demarcations we use to identify origin or authenticity' (Hattingh, 2001, p. 191). It involves drawing fixed lines through fluid, hybrid spaces (J. Fall, 2005; Whatmore, 2002).

Consequently, many critics argue that the terms are sufficiently arbitrary, malleable and culturally contingent that the labels make little ecological sense (Davis, 2009; Guiasu, 2016; Guiasu & Tindale, 2018; Katz, 2014; Robbins, 2004; Thomas & Ohlemüller, 2010;

Thompson, 2014; Valéry et al., 2013). According to Chew (2011, p. 138), 'the idea that nativeness is anything but historically incidental is theoretically untenable'. This imperspicuity is reflected in the numerous typologies proposed for this complex overlapping space (e.g. Crees & Turvey, 2015) and the existence of many intermediate terms. A key point of disagreement is the degree of human agency required for a newly-arrived species to be classified as alien (direct *v*. human-mediated) (Gilroy et al., 2017). A final, empirical, problem in classifying species according to the timing and/or mode of arrival is that new research can, at a stroke, transform a species' status and hence its perceived worth (Crees & Turvey, 2015; Gillson, 2015). Even for the well-studied British flora, the status of some 20% of native species is doubtful (Thompson, 2014), and uncertainties about historic distributions and anthropogenic influences surround many species (Simberloff, 2012; Thomas & Ohlemüller, 2010; Willis & Birks, 2006). Such questions are, in one sense, simply scientific puzzles. The issue is that so much hangs on the outcome, with the bifurcation leading to diametrically contrasting attitudes and prescriptions – from cherished protection to ruthless extirpation.

These definitional problems are widely acknowledged (Gilroy et al., 2017), but the relational and socially constructed character of these terms suggests that watertight definitions are inherently unachievable. Going further, Chew and Hamilton (2011, p. 45) contend that nativeness itself is conceptually indefensible, while both Salisbury (1961) and Valéry et al. (2013) conclude that the 'native' label is of little scientific or practical value. Classifications like the NAC – and the concept of species of which it is a subset and which is itself contested (Barras, 2019; Kunz, 2013) – are socially constructed categories which inevitably correspond imperfectly with the continua of nature. To elevate them from scientific tools to ruling paradigms is to fall into the reification trap of treating cultural constructs as real entities (Slobodkin, 2001). The messy fluidity of nature does not mesh neatly with our desire for tidy categories and clear legal definitions. For all these reasons, the NAC is criticized as a questionable framework for evaluating species' worth and for guiding management prescriptions.

Inflexible Dichotomies in a World in Flux

The concepts of nativeness and alienness also attract criticism for imposing an essentializing, dichotomous rigidity onto the evolving continua of ecosystems, both *via* the classification itself and the values implicit within it. In terms, firstly, of the classification, the paradigm rests on the belief that every species has a place where it 'belongs' (Steer, 2015). Labeling a species 'native' implies that it is in its rightful place, while 'alien' implies the converse – a species 'out-of-bounds, out-of-place and out-of-control' (Fall, 2014b, p. 167). But ecologies are always in flux. Current distributions represent one frame in the film of life on Earth, so asking where a species belongs can have no unqualified, immutable answer (Thompson, 2014). Taking the long view, there is no 'correct' species assemblage for a place because a region's current complement of species is a matter of historical accident and biogeographical happenstance (Soulé, 1990; Thomas, 2017). The inflexible, essentializing character of the NAC is at odds with a fast-changing world in which 'fixed ideas of belonging no longer work' (Gibbs et al., 2015, p. 58). The concept of nativeness is therefore criticized for fossilizing nature (Brown, 1997), and has itself been dubbed 'a living fossil of an outmoded phytogeography' (Chew & Hamilton, 2011, p. 45).

Secondly, the values implicit within the NAC are similarly critiqued for being inappropriately dichotomous, with particular condemnation reserved for the 'native good, alien bad' binary. This equates 'native' with 'best', a framing which is demonstrably inaccurate and misleadingly simplistic (Goodenough, 2010; Kendle & Rose, 2000). As Levinovitz (2020, p. 3) argues, 'an oppositional binary between "natural" and "unnatural" … trades complicated truths for the comfort of clear categories [and] encourages dogmatism over compromise, certainty over humility and simplicity over nuance'. A key rationale for preferring native species is the argument that they are optimally adapted to their location. Nativeness, however, is not a sign of evolutionary fitness but simply describes the species which happened to arrive and flourish first (Davis et al., 2011; Gould, 1998). Consequently, according to Gould (1998, p. 8), the notion that native species are morally or practically superior 'must be dismissed as romantic drivel'. In practice, however, this belief is continually reinforced by the widespread use of imprecise language – employing 'alien' as a proxy for harmfulness, using 'invasive' and 'native' as antitheses, and utilizing 'alien' and 'invasive' alone as shorthand for 'invasive alien' – usages which are common even amongst experts (Humair et al., 2014; Selge et al., 2011; Van der Wal et al., 2015). This has had the pervasively insidious effect of associating all introduced species with damaging impacts and all invasive behavior with aliens, bolstering a Manichean narrative.

A Concept Marred by Myths

A final criticism of the paradigm itself is that it incorporates and perpetuates outmoded thinking and discredited myths – three in particular. The first is the Romantic conception of 'the balance of nature'. Notwithstanding the decisive shift to non-equilibrium thinking in ecology, the foundational ecological metaphor of the balance of nature remains influential in conservation thinking, policy and practice (Jelinski, 2010). Equilibrium thinking, which is implicit in the terminology of ecosystem 'disturbance', 'disruption' and 'recovery', pervades invasion science (Steer, 2015), and is ingrained in public perceptions of alien species (Verbrugge et al., 2013). The Edenic perception of a natural order comprising native species existing in stable harmony is regularly debunked but it runs deep (J.H. Lawton, 1997; Trudgill, 2008). The persistence of this paradigm reinforces the native/alien dichotomy because if stability and balance are defining characteristics of nature, alien arrivals are inherently disruptive and unwelcome, whereas a view of nature as dynamic can embrace novel possibilities (Kueffer & Kull, 2017).

Secondly, the NAC is premised on a pre-Darwinian conceptual separation of human beings from nature such that anthropogenic species dispersal renders nature unnatural (Sagoff, 2020). The classification can only function if humans are excluded from it (Preston, 2009). Such ontological dualism underlies the powerful Western cultural norm of valuing 'unspoiled nature' above human-modified systems (Inkpen, 2017) and yet it is hard to find a compelling reason why the claimed metaphysical distinction has ethical relevance (Lockwood & Latchininsky, 2008; Sagoff, 2013). Despite the decades-long critique of this Cartesian separation (Castree, 2005, 2014), it persists as one of 'the conservation "myths" we live by' (Brennan, 2018, p. 159). The emergence of the Anthropocene reinforces the view that this conceptual framework is untenable (Corlett, 2015; Inkpen, 2017), and 'disrupts any lingering notion that we can think of the environmental and social realms as separate and separable' (Head, 2015, p. 318). The NAC serves to perpetuate nature-culture boundaries because alienness is defined in terms of human agency, not in relation

to biological characteristics, and such a definition falsely positions humans as exogenous to the environment instead of co-constitutive of it (Head, 2008, 2017; Inkpen, 2017). If it is accepted that separating anthropogenic dispersal from all other kinds of dispersal distorts the ecological fact that humans are always already transforming the world and thus inseparable from it, the distinction is redundant (Frank, 2019; Head, 2017; Vogel, 2016). Treating the agency of *Homo sapiens* as sufficiently distinct from every other process that it can act as a primary demarcation between species which are 'desirable' and 'undesirable' is thus indefensible, especially given the disagreements noted above over the degree of human agency deemed necessary to render a species alien.

The 'pristine myth' is the third discredited conception. This is the beguiling notion that the new worlds encountered by European explorers consisted of primeval, unhumanized environments (Denevan, 2011), whereas early human societies have actually been transforming global ecologies for millennia, even in apparently unaltered places (Ellis, 2015; Lyons et al., 2015; Simberloff, 2013). Consequently, in most parts of the world, the ideal of 'unspoiled nature' which provides the reference conditions for the NAC resides so far back in history as to be irrelevant to the present and becoming world. The pristine baseline 'is a mirage, receding as it is approached' (Head, 2000, p. 4). Pristine is history; we live 'after nature' in a no-analogue world (Purdy, 2018; Vogel, 2016). Consequently, according to Mastnak et al. (2014), any definition of native species as independent of human agency is no longer tenable.

Critiques of the Application of the Native/alien Paradigm

The previous section presents a range of arguments indicating that the concept of biotic nativeness 'dissolves under empirical scrutiny' (Head, 2012, p. 168). If so, its adoption as an axiom of management is inherently problematic, explaining why its practical application has proved increasingly controversial. This section outlines salient critiques of the implementation of the NAC.

Exceptions, Inconsistencies and Value Conflicts

Critics contend that the application of the NAC is shot through with contradictions, anomalies and cultural contingencies because invasions are not simply biological but social-ecological phenomena (Estévez et al., 2014). The reasons why society chooses to favor particular species and reject others comprise a diverse and evolving mixture of value-laden and culturally shaped factors – ecological, sociocultural, emotional, economic, historical and esthetic (Kueffer & Kull, 2017; Trudgill, 2008). Consequently, in practice, there are innumerable instances in which criteria other than a species' origins determine how it is evaluated and managed (Chew & Hamilton, 2011; Head, 2012). In particular, when alien species are valued for economic and/or cultural reasons, exceptions are frequently made to welcome and even cherish them, so that introduced species have become integral to human welfare throughout the world (McNeely, 2001). Arguments for exceptions are also made on ethical grounds. Hettinger (2021), for example, believes that the generalized antipathy toward alien species is fully justified but argues that exceptions should be made for sentient animal species.

The value and usefulness of a framework which is so pervasively superseded by other considerations must be questioned, especially when historical and cross-cultural perspectives show how changeable and varied social perceptions of 'good nature' are. Species

lauded by one generation or society may be targeted for eradication by another, and the 'pests' of one era may rapidly morph into cherished conservation icons in the next (Smout, 2011). As a Roman proverb put it, *'Tandem aliquando invasores fiunt vernaculi'* – 'In time, invaders become the natives' (*in* Van Eeden et al., 2020, p. 4). 'Native' was once a term of contempt while 'exotics' were sought after (Mastnak et al., 2014), and only in recent times has the practice of cosmopolitan enhancement of nature been replaced with its mirror image – nativist protection through exclusion (Sandiford et al., 2015). There is thus no single, unchanging 'truth' about which species are desirable and undesirable (Thomas, 2017). Even within today's scientific community, normative views concerning the value and treatment of alien species vary considerably (Gbedomon et al., 2020; Humair et al., 2014).

Moreover, there is well-documented divergence between the values of conservation science and the complex mix of values in the wider sociopolitical landscape (Bach, 2019; Bhattacharyya & Larson, 2014; Estévez et al., 2014; Gibbs et al., 2015; Kapitza et al., 2019; Selge et al., 2011). For example, Australian Aboriginal people regard many introduced species as valuable and 'belonging' (Bach, 2019; Gibbs et al., 2015), many British people do not accept the 'alien grey squirrel as pest' narrative (Dunn et al., 2018), and New Zealand's 'Predator Free 2050' campaign conflicts with Maori cultural beliefs (Linklater & Steer, 2018; Owens, 2017). Furthermore, beliefs about nativeness are often not a significant determinant of public attitudes (Shackleton et al., 2019b, 2019c; Van der Wal et al., 2015). Instead, the lay public evaluates non-native species primarily by their behavior, impacts and appearance (Head, 2014; Selge et al., 2011), and alien species are often incorporated in people's sense of place, with some even being cherished as iconic and becoming culturally native (Knights, 2008; Kueffer & Kull, 2017; Van Eeden et al., 2020). Such contrasts frequently generate conflict over the desirability and ethics of control of alien species, especially when management involves killing sentient and/or valued species (Crowley et al., 2017a; Van Eeden et al., 2020), as discussed below. In practice, therefore, the application of the NAC is inconsistent in space and time, and often not congruent with social values.

Lastly, a geographical inconsistency highlighted by critics is the variability and inappropriateness of the scales at which the NAC is applied. Notably, the nation is a common scale of environmental governance, but parceling up seamless nature into political spaces makes no functional ecological sense (Brown, 1997); some nations are too small, others too large, and many national borders cross-cut ecological units (Head & Muir, 2004; Taylor, 2005). But because legal responsibilities for protecting biodiversity rest with national governments, and the nativeness of species is often defined in relation to political territories, this inappropriate and inconsistent scale has become the norm for the application of the NAC (Antonsich, 2020; Fall, 2014a, 2014b). That some political territories are the expression of colonial and neocolonial logics only creates further difficulties (Sinclair & Pringle, 2017).

Provocative Metaphors and the Charge of Xenophobia

'Invasion' features in the title of Elton's seminal book and defines invasion science, but the use of the word itself and of the many accompanying military metaphors has been much criticized as inflammatory, polarizing and hyperbolic (Davis, 2009; Larson, 2011). While bellicose anti-alien metaphors can motivate conservation volunteers, they can also prove counter-productive, offending the public on whose support conservation depends (Keulartz & van der Weele, 2009). Many have also critiqued the routine use of stigmatizing

anthropomorphisms (Coates, 2011, 2015; Guiasu, 2016; Warren et al., 2017). Metaphors are powerful. Far more than innocent linguistic flourishes, they have the power to structure modes of thought and action with material, geographical consequences (Keulartz, 2007; Keulartz & van der Weele, 2009). All too easily reified (Fall, 2014a), they can mold attitudinal and behavioral norms and shape decision-making frameworks (Larson, 2018; Qvenild, 2014; Verbrugge et al., 2016). This is especially true of metaphors of displacement such as 'alien invasions' which, by telling us 'what and who belong where', become 'constitutive moments in the spatiality of everyday life' (Cresswell, 1997, p. 334). Because metaphors inconspicuously trespass across the philosophical schism between what is and what ought to be (Larson, 2018), they can be dangerously misappropriated and wielded as enforceable prescriptions (Chew & Laubichler, 2003). An egregious example is the application of ecological metaphors of displacement to justify urban ethnic segregation in mid-20th century America (Cresswell, 1997). Such linguistic, metaphorical issues lie at the heart of perhaps the most deeply contentious aspect of native/alien debates, namely the accusation that anti-alien discourse is xenophobic.

It is a deeply human trait to identify with a homeland or a home tribe, to differentiate 'us' from 'them' and to vilify outsiders as enemies (Culotta, 2012; Davis, 2009), but whether this innate tendency to draw boundaries between in-groups and out-groups and then to discriminate across them is helpful or harmful when applied to other species is questionable. The incendiary allegation is that the concept of nativeness itself 'really amounts to a form of racism, almost an ecological fascism' (Trudgill, 2001, p. 680), and that pro-native policies are xenophobic, redolent of Nazi horticulture (Brown & Sax, 2004, 2005; Coates, 2011, 2015; Gröning & Wolschke-Bulmahn, 2003; Katz, 2014; Peretti, 1998; Theodoropoulos, 2003). In environmental discourses, human and biotic communities are conflated in myriad ways, especially in relation to the intertwined and co-rooted ideas of nature, native and nation (Head & Muir, 2004; Smith, 2011; Warren, 2011). All three rely heavily on the fiction that these concepts are given, not constructed (Biermann, 2016), and all have close linkages with identity (Fall, 2014a; Olwig, 2003). As Antonsich (2020) shows, ideas of nativeness and alienness have developed in conjunction with the nationalization of nature and the naturalization of nation, with consequent conflation of ecological and political nationalistic narratives.

Framing alien species as immigrants has been a common metaphor since Elton (1958), and there are undeniable rhetorical parallels and cultural/psychological entanglements between anti-immigrant and anti-alien species discourses, each being framed in terms of native purity being contaminated by illegitimate newcomers (Caluya, 2014; Frank, 2019; Inglis, 2020; Stanescu & Cummings, 2017b; Subramaniam, 2017). Such parallel arguments against alien people and non-human alien species are mutually reinforcing (Sinclair & Pringle, 2017). Explicit comparisons between 'foreign' species and 'othered' humans are not only commonplace but have become integral to biopolitical governance, exemplified by President Bush's relocation of staff responsible for invasive species management to the Department for Homeland Security after the 9/11 attacks on the USA (Steer, 2015) and Australia's 'Safeguarding Australia' policy which aims to protect the nation from terrorism, crime, invasive diseases and pests (Caluya, 2014). Branding invasive species as security threats to the 'pure' homeland (e.g. Simberloff et al., 2020) reinforces the nativist foreigner-as-threat imagery which pervades the invasion biology literature (Fall, 2014b; Katz, 2014; O'Brien, 2006; Subramaniam, 2017). The selection of the date of European

colonization as the defining temporal threshold of nativeness (e.g. 1492 in the USA, 1788 in Australia) embodies a further subtle form of racism by implicitly classing indigenous peoples as sub-human, belonging to wild nature not human civilization (Head, 2012).

Importantly, those who level such charges of xenophobia are careful to absolve individual conservation scientists of intentional racism. Their concern is the risk that the science or rhetoric could have unintended social effects and cause offense (Frank, 2019; Keulartz & van der Weele, 2009). Using language with xenophobic associations is morally inappropriate (Inglis, 2020), and as Gould (1998, p. 4) warns, there is a slippery slope between benevolent pro-native sentiments and 'dangerous *Volkist* nationalism'. Such slippage is not a theoretical risk but an observed phenomenon (Coates, 2011; Selge et al., 2011; Switzer & Angeli, 2016). It has occurred, for example, in the contemporary resurgence of Far Right nationalism, incorporating eco-fascism, which has seen biological and cultural nativism becoming mutually reinforcing *via* rhetorical cross-fertilization (Camus, 2021; Hettinger, 2021; G. Lawton, 2019). Similarly, Kim (2015), explores the way in which race and species operate as conjoined logics, or mutually constitutive taxonomies of power, illustrating how the treatment of non-human species is deeply connected with political debates over race and ethnicity. Discussions about hybridization, with talk of genetic purity and pollution, often come closest to overt racist language (Simberloff, 2012; Smout, 2011). Minority ethnic groups can find conservationists' pursuit of genetic purity deeply uncomfortable because 'it is impossible to distinguish the arguments for preserving every genotype from arguments for racial purity in human beings' (Smout, 2003, p. 19). From an immigrant's perspective, 'the rhetoric is unmistakable' (Subramaniam, 2001, p. 27). Given these overlaps, Peretti (1998, p. 189) argues that 'nativist purism is undesirable in all spheres – politically, culturally and ecologically'.

The Ethics of Care and Killing: Critiques of Eradicating Aliens for Conservation

In addition to the philosophical dimensions of the multi-disciplinary critiques above, there are a number of intertwined arguments against the NAC which have been explored primarily in the philosophical literature, especially concerning the ethical difficulties of its implementation. These revolve around the ethics of killing for conservation, an issue of increasing concern in wider society (Cowan & Warburton, 2011; Crowley et al., 2017a). The NAC constitutes not just an ecological and socio-political framework but also an 'ethical taxonomy' defining valued natures, with the 'invasive' label in particular performing a deadly kind of ethical work by stripping species of the moral status that they would otherwise have (Clark, 2015; Van Dooren, 2011). The terminology operates as an ethical shortcut, rendering particular non-human species 'killable' without further debate because the values are implicit within the framework. If biodiversity is defined as native biodiversity, destroying species which are deemed not to belong becomes an unquestioned necessity of biodiversity conservation. Moreover, the normative labels provide an unwarranted degree of moral comfort, simplifying ethical complexities and justifying lethal violence because 'these lives are not *legitimate* lives' and so their deaths are '*demanded*' (Van Dooren, 2011, p. 290; Van Eeden et al., 2020). Consequently, modes of killing which would never be tolerated for native species become acceptable and even celebrated (Inglis, 2020; Trigger et al., 2008). Given that the *raison d'être* of conservation is caring for non-human nature and protecting it from human impacts, the prominent role of killing within conservation practice is both surprising and ethically troubling (Hartman & Wooley, 2020). Srinivasan and

Kasturirangan (2017) examine this contradictory coexistence of care and killing, providing an insightful exploration of how the overarching objective of caring for nature could have given rise to conservation programmes (pogroms?) which mete out violence, suffering and death on an industrial scale – how killing becomes an act of care.

A well-developed ethical case exists against campaigns to extirpate invasive aliens, a case comprising three main arguments. The first is that the problems which such programmes aim to address are entirely human in origin, involving human-mediated introductions and the facilitation of invasions by anthropogenic habitat change, and so eradication campaigns involve scapegoating and punishing the innocent while exculpating ourselves (Inglis, 2020; Macdonald et al., 2007; Srinivasan & Kasturirangan, 2017; Thompson, 2014). As Subramaniam (2017) notes, the problems are misleadingly presented not as 'human problems' but as 'alien species' problems. Ingrained ontological dualism permits us to remove ourselves from the frame and turn a blind eye to the fact that human beings are 'the destructive invasive species *par excellence*', the most virulent of them all (Stanescu & Cummings, 2017b, p. x; Hartman & Wooley, 2020). In practice, the NAC thus insidiously shifts the burden of guilt from 'us' to 'them', helping to justify lethal control. In this context, Steer (2015) makes the telling point that the immigrant metaphor is an inaccurate analogy for alien species. Instead, he argues, the history of slavery is a more accurate parallel because introduced species are subjected to abduction, exploitation, emancipation and a legacy of discrimination. This reframing casts alien species as victims rather than villains, guilty of nothing more than being themselves in a place not of their choosing; they are thus more sinned against than sinning. This supports the contention that alien species are symptoms, not drivers, of change (Table 1).

A second ethical argument against extirpation is that it amounts to abuse (Srinivasan & Kasturirangan, 2017). By adopting collective ontologies – populations, ecosystems, species, biodiversity – the individual organisms that suffer and die 'for the greater good' are rendered invisible, enabling mass killing to become normalized and socially acceptable. Within a rights-based paradigm this creates a conflict between the right to life of non-native individuals and the right to integrity of threatened ecosystems, a collision which is far from easy to resolve (Futhazar, 2020). The argument for a shift of focus from the collective to the individual (Aitken, 2004) has become a central tenet of 'compassionate conservation' which is advocated as a more ethically justifiable approach (Morris, 2020; Wallach et al., 2018).

A third critique is that eradication programmes do not satisfy the ethical justifications to which they lay claim. Such campaigns are often championed using militaristic language which seeks to justify the role of humans as 'moral predators' in a 'just war' so that killing for conservation is not just acceptable but lauded as a moral duty in pursuit of the greater good (Steer, 2015); thus 'the best conservationists . . . are the best murderers, essentially' (conservationist as cited in Steer, 2015, p. 247). However, ethical evaluations of one high-profile national programme – New Zealand's 'Predator Free 2050' campaign – conclude that it violates all the central tenets of the 'just war' theory (Morris, 2020), as well as being questionable on many other grounds (Linklater & Steer, 2018). Probing questions about the coherence of the arguments for extermination campaigns are also raised by Lockwood and Latchininsky (2008). Using an archetypal case study of the invasion of a remote island by an alien species, they find that the conventional justifications for extirpation are ethically unsound, logically inconsistent and ecologically implausible. Making a wider point, they go on to argue that just as a moral position cannot legitimately

be derived from empirical facts ('ought' from 'is', i.e. Hume's naturalistic fallacy), so it is not ethically valid to deduce 'ought' from 'was', that is, from a historical ecological state. They dub this the conservationist fallacy.

Considerations such as these lead many philosophers to question the coherence of conservation efforts based on the NAC (Hartman & Wooley, 2020; Inglis, 2020) and to argue for a more flexible, inclusive and pragmatic environmental ethics which values and cares for all species according to their merits in each context (Switzer & Angeli, 2016; Van Dooren, 2011). Advocates of this approach call for the adoption of a more-than-human cosmopolitics (Stanescu, 2017), one which welcomes the stranger and foreigner (Guiasu & Tindale, 2018; Keulartz & van der Weele, 2009; Sagoff, 2005). 'If peaceful coexistence in a multicultural society is a good goal for humans, why not for other species?', asks Peretti (1998, p. 190). Inglis (2020) goes further, arguing that the terms 'alien' and 'invasive' should be discarded altogether on the grounds that 'demonization' of species is morally wrong because it systematically devalues animal life and frequently results in unjust killing and extreme cruelty.

Exaggerated Impacts

A final charge leveled against the implementation of the NAC is that the negative impacts of alien species are inflated, leading to disproportionate policy responses. That invasions can be ecologically, economically and socioculturally serious is beyond question. Nevertheless, critics argue that some of the frequently repeated claims about the damaging impacts and potential threats of invasive alien species are exaggerated. These are summarized in Table 1.

Table 1. Impacts and threats of invasive alien species (IAS) which critics of invasion biology argue are exaggerated.

Type of Impact	Critique	References
Biodiversity impacts	Introductions generally increase, not decrease, biodiversity, and rarely cause extinctions. Biodiversity is changing, but there is no systematic loss. Species mixing decreases difference between regions but increases local species richness. Biodiversity losses are driven mainly by over-exploitation and agriculture, not IAS.	Brown & Sax, 2004; Gurevitch & Padilla, 2004; Davis et al., 2011; Dornelas et al., 2014; Thomas & Palmer, 2015; Maxwell et al., 2016; Briggs, 2017; Thomas, 2013, Thomas, 2017; Dueñas et al., 2018; Primack et al., 2018; Sagoff, 2018b, 2020; Velland, 2018
'The second greatest threat'	No empirical foundation for the frequently repeated claim that IAS are the second greatest threat to global biodiversity after habitat loss.	Sagoff, 2005; Davis, 2009; M.K. Chew, 2015
Ecological impacts	Negative ecological impacts are often over-stated and weakly supported by scientific evidence. Native ecosystems may recover well in the long term from initial impacts. Clear evidence exists of context bias in invasion biology, exaggerating the harmfulness of IAS and downplaying damage by invasive native species.	Goodenough, 2010; Carey et al., 2012; Thompson, 2014; Warren et al., 2017; Guerin et al., 2018; Vimercati et al., 2020
IAS as drivers of change	IAS are not drivers of change but opportunistic exploiters of change caused by other (typically anthropogenic) factors, i.e. IAS are symptoms not drivers. Correlations between alien increases and native declines are often assumed to be causative without empirical justification.	Gurevitch & Padilla, 2004; Brown & Sax, 2005; Didham et al., 2005; M. Chew, 2009; Thompson, 2014; Pearce, 2015; Shirley, 2019
Economic impacts	Estimates of economic impact are exaggerated, dubious and distorted, ignoring positive contributions of introduced species. Research is biased toward documenting negative economic impacts of IAS.	Schlaepfer et al., 2011; Thompson, 2014; Pearce, 2015; Kareiva & Marvier, 2018; Sagoff, 2009, 2020

Judging Species by Behavior Not Origins?

The above sections summarize multidisciplinary scholarship which is critical of both the conceptualization of species as native or alien and the application of this framework. A frequent recommendation is that the use of biogeographic origins as a central criterion in conservation should be abandoned in favor of impact-based evaluations (Aitken, 2004; Gould, 1998; Lodge & Shrader-Frechette, 2003; Radomski & Perleberg, 2019; Sagoff, 2005; Switzer & Angeli, 2016; Thomas, 2013, 2017; Thomas & Ohlemüller, 2010; Thompson, 2014; Warren, 2007). Thus Davis et al. (2011, p. 153) argue that 'it is time … to ditch this preoccupation with the native-alien dichotomy and embrace more dynamic and pragmatic approaches' based on functional criteria, while Primack et al. (2018) ask whether managers should focus on ecosystem processes and services regardless of species' biogeographic origins. If so, the defining issue would cease to be species' 'immigrant status' but whether they are well-behaved citizens of the ecological community (Aitken, 2004; Callicott, 2002; Warren, 2007).

The contention is that species and ecosystems of all kinds should be valued for what they are and do, not because of how they came to be. This includes recognizing the value of novel or no-analogue ecosystems and moving away from a focus on preserving existing or historical assemblages (Hobbs, 2016; Hobbs et al., 2009; Vince, 2011). The growing evidence that novel ecosystems are now the norm, not the exception (Dornelas et al., 2014; Russell & Kueffer, 2019), suggests that the traditional approach is obsolete, and that a more flexible methodology is needed in which conservation management focuses on functional integrity rather than particular species (Barnosky et al., 2017; Hobbs et al., 2009; Kueffer & Kaiser-Bunbury, 2014). Such arguments emphasize the positive contributions that alien species can make to regional species richness, to ecosystem services and resilience, and to delivering conservation and restoration goals (Ewel & Putz, 2004; Goodenough, 2010; Guiasu, 2016; Lundgren et al., 2018; Schlaepfer, 2018b; Schlaepfer et al., 2011; Tassin & Kull, 2015; Thomas, 2013). The same reasons that make some alien species so successful (adaptability, vigor, resilience) render them potentially beneficial in an increasingly human-dominated world (G. Hamilton, 2011; Inglis, 2020). In the long term, introduced species may enhance ecosystem resilience by driving evolutionary adaptation, in which case the eradication of alien species may prove counterproductive (Schlaepfer et al., 2011; Steer, 2015). Arguably, therefore, the beneficial impacts of alien species deserve greater recognition in scientific debates and management decisions (Vimercati et al., 2020).

Thus by helping social-ecological systems adapt to global change, alien species and novel ecosystems 'may potentially be considered as "good"' (Tassin & Kull, 2015, p. 165). Even hybridization may be regarded as a beneficial evolutionary adaptation, both by increasing a population's fitness and resilience (Guiasu, 2016; Steer, 2015) and by counteracting the homogenizing effects of globalization (Keulartz & van der Weele, 2009; Thomas, 2017). For all these reasons, Schlaepfer (2018b) argues that we will need to make space – both physically and intellectually – for alien species in the future. This is not to deny or minimize the undoubted negative impacts that certain non-native species can have, but to argue that dispassionate, multi-criteria evaluations of species functions should take precedence over origin-related criteria. Given that species have both negative and positive impacts (Shackleton et al., 2019a), and that these are variable and context-

dependent, generalizations about species' impacts are inappropriate (Boltovskoy et al., 2018). Barnosky et al. (2017, p. 1) synthesize such evidence and arguments to make a strong case that 'conservation success requires a paradigm shift from maintaining ecosystems in idealized past states toward facilitating their adaptive and functional capacities'.

Discussion

Rebuttals, Dismissals, and Accusations of Denialism

The critical literature synthesized above has elicited robust responses and counter critiques defending the scientific rigor and value of both the NAC and invasion biology (Kuebbing & Simberloff, 2015; Simberloff, 2011b, 2013; Simberloff et al., 2013; Simberloff & Vitule, 2014), including point-by-point rebuttals (Richardson & Ricciardi, 2013). In the view of many invasion biologists, species origin remains a valid, pragmatic and relevant consideration in conservation management, and to suggest that alien species are anything other than a major threat to biodiversity and ecosystem services is to ignore decades of peer-reviewed science (Preston, 2009; Sandiford et al., 2015; Simberloff, 2013). The claim that invasion biology promulgates a good/bad dichotomy is rejected as a misrepresentation (Richardson & Ricciardi, 2013; Simberloff, 2003, 2011a; Simberloff et al., 2013). Accusations of xenophobia have understandably provoked strong responses (Simberloff, 2012; Simberloff & Vitule, 2014), and are dismissed as being 'as unfounded as they are unreasonable' (Courchamp et al., 2017, p. 18). In this view, the focus on biogeographic origins is not racist but is based on principles analagous to the defense of human cultural distinctiveness in the face of homogenizing globalization (Hettinger, 2001; Simberloff et al., 2013).

The most recent phase of the debate has seen the stakes raised still further, with accusations of 'invasive species denialism' being leveled at critics of the central tenets of invasion biology. Russell and Blackburn (2017) and Ricciardi and Ryan (2018) charge such critics with misrepresenting and cherry-picking data, rejecting evidence, manufacturing doubt and being motivated by vested interests. In turn, these papers prompted swift and forthright responses arguing, *inter alia*, that the assertion that there is a strong scientific consensus supporting invasion biology is inaccurate (Crowley et al., 2017b; Guiasu & Tindale, 2018; Munro et al., 2019; Sagoff, 2018a, 2018b), that science alone is incapable of evaluating harm (Sagoff, 2018b; Tassin et al., 2017), and that the axiomatic generalization that invasive alien species greatly imperil biodiversity rests on weak empirical foundations (Boltovskoy et al., 2018; Briggs, 2017; Davis & Chew, 2017; Guerin, 2019). The fact that experts come to diametrically opposite conclusions about whether the critical arguments do constitute denialism (Frank, 2019; Ricciardi & Ryan, 2018) or do not (Crowley et al., 2017b; Munro et al., 2019) indicate that denialism may exist largely in the eye of the beholder. Intriguingly, a subsequent survey within the scientific community indicates that the so-called 'denialist' position may actually be a majority viewpoint, with most respondents regarding the NAC as artificial and counterproductive (Gbedomon et al., 2020).

It seems clear that it is inappropriate to evaluate alien species negatively *solely* on the basis of their non-native status because this closely parallels xenophobic racism and is

ethically indefensible (Switzer & Angeli, 2016). As Simberloff (2012) acknowledges, it is a small step from fostering distinctive local culture to stigmatizing and 'othering' outsiders. But given the empirical reality that a small minority of alien species become seriously harmful, the challenge is to find a line between unacceptable anti-foreigner attitudes and potentially damaging *laissez-faire* approaches – in other words, how to be carefully discriminating without crossing the line into inappropriate discrimination. Does such a middle line exist?

Reframing a Polarized Debate?

The discourses surrounding native and alien species are unusually acrimonious and polarized. Exchanges are replete with accusations of attacks on straw people, of pursuing red herrings, of cherry-picking evidence and of attempting to shut down discussion, together with outspoken attacks and disparagement of arguments from certain disciplines (Guiasu & Tindale, 2018; Russell & Blackburn, 2017; Simberloff & Vitule, 2014). For example, Davis and Chew (2017, p. 229) describe the 'denialism' attacks as 'invasion biology's desperate last stand' reflecting its 'traditional reliance on inflammatory exaggeration to impose and enforce a dichotomous doctrine'. The two sides are as far apart as ever. Whereas Van der Wal et al. (2015, p. 349) believe that the longstanding critiques of 'the morality, logic and utility of using nativeness as a guiding principle in nature conservation' are coming to fruition, advocates of invasion biology beg to differ, remaining mystified and infuriated in equal measure by the continuing criticisms which, in their view, have been repeatedly and comprehensively refuted (Anthony, 2017). Some common ground does, nevertheless, exist. There is an overwhelming consensus that invasive alien species can be ecologically and economically damaging (Boltovskoy et al., 2018), and it is widely acknowledged that the definitional boundaries around 'native' and 'alien' are 'fuzzy [and] to some extent arbitrary' (Simberloff, 2012, p. 10; Young & Larson, 2011). Most agree that the vast majority of introduced species cause no problems, that many provide benefits and that native species can cause serious problems. But the emphases of critics and advocates are radically different. The *raison d'être* of invasion biology is understanding and countering the negative impacts of alien species, especially invasives, whereas critics adopt a broader perspective, balancing negatives with positives, and are more pragmatically accepting of change.

Nevertheless, attempts have been made to map out middle ground in this polarized, entrenched terrain. Shackelford et al. (2013) propose that the longer established a species is, the less significant a criterion its origin should be. They suggest that it is prudent to eradicate new, unintended introductions because of the difficulty of predicting their future behavior and interactions, but that the management of established species should primarily be based on place-specific evaluation of their impacts (positive and negative). This recognizes that, while there are strong reasons why we should not judge species on their origins *alone* (Davis et al., 2011), there are also good arguments for including information about biogeographic origins in our management of species (Frank et al., 2019; Simberloff et al., 2011b). In this vein, Buckley and Catford (2016, p. 4) declare that 'species origin should not, on its own, be used as a shortcut for management decisions', but proceed to argue that it should remain a part of those decisions. The complexity of environmental evaluation suggests that species origin can only ever

be one factor amongst many when deciding which are welcome or unwelcome. Consequently, the prominence given to the native/alien distinction as a key evaluative criterion is an unhelpful simplification because it implies that origin is the first and foremost consideration. A more nuanced approach, combining origin and impacts, offers a middle way.

Since it is arguably the language and the justifications for management decisions which are most in need of critical reevaluation (Warren, 2011), many have advocated more neutral terminology (Colautti & MacIsaac, 2004), shorn of normative implications, perhaps involving a return to older terms such as 'pest' and 'weed' which focus on behavior not origin (Smout, 2003). For example, Davis (2009) recommends the use of descriptive terms which avoid dichotomous labeling and pejorative associations, distinguishing species simply on the basis of residence time in a region. Using similar reasoning, Inglis (2020) suggests the term 'potential problem species'. Caring for nature can be supported with numerous arguments which do not need to employ the language of natives and aliens or the rhetoric of naturalness and authenticity. As Davis (2009, p. 165) comments, 'it should not be necessary to promote a native vs alien dichotomy to get society to respond' as long as the species in question are causing real harm.

There would be greater scope for consensus-building if it was truly the case, as asserted by defenders of invasion biology, that only those alien species which cause harm are opposed and that not all aliens are seen as 'bad' (Richardson & Ricciardi, 2013; Simberloff, 2003, 2011a; Simberloff et al., 2013). But this does not appear to be so. Alien species are conceptualized as an environmental problem in themselves, regardless of their impacts (Guerin et al., 2018; Heink et al., 2018), and many invasion biologists believe that alien species are inherently undesirable (Young & Larson, 2011). The advocacy of a precautionary approach – because of the difficulty of predicting the long-term impacts of alien introductions (Frank et al., 2019; Simberloff, 2013) – unavoidably treats all alien species as potentially harmful. Framed as an intrinsic threat, aliens are thus presumed guilty until proved innocent (but always potentially guilty) (Guiasu, 2016; Guiasu & Tindale, 2018). Hettinger (2021) explicitly defends this antipathetic approach as fully justified. But it is precisely this treatment of aliens as inherently negative that is a key focus of criticism. Defining natives as the only species which rightfully 'belong' inevitably identifies aliens as not belonging and hence undesirable. At present, consensus-building seems a distant prospect.

The Unbearable Tension between Description and Prescription

Despite the areas of agreement and various constructive proposals for de-escalating the war of words, the debate rages on. Munro et al. (2019) argue that its insolubility stems from a fundamental mismatch between, on one side, those focusing on scientific evidence (which they think is being 'denied') and those on the other contesting values. There is truth in this, but values underlie the arguments on both sides, values which support contrasting worldviews about what nature should be (Simberloff, 2012). This reflects the fact that 'conservation is a practice with ethics at its core' (Wallach et al., 2018, p. 1256) – an inherently values-driven, emotive, humanistic pursuit guided by a fusion of ecological science and cultural constructs (Brennan, 2018; Clayton & Myers, 2009; Silliman & Wear, 2018; Trudgill, 2001, 2008). It is informed by science but

motivated by values. Given the normative force of the labels 'native' and 'alien', invasion biology is a substantively value-laden science (Davis, 2009; Essl et al., 2017; Frank, 2019), and has often been criticized for being so (Sagoff, 2018a; Tassin & Kull, 2015; Warren et al., 2017), especially when value judgments are portrayed as scientific facts (Qvenild, 2014). Although the mixing of values and science is unavoidable (Primack et al., 2018), it is not unproblematic because apparently scientific terms like pristine, disturbed and integrity are normative, implying a preferred state of nature (Kueffer & Larson, 2014).

A central and contested value judgment is whether *change* constitutes *harm*. Whereas change can be scientifically quantified, harm is socially constructed and value-laden (Verbrugge et al., 2016). The questions of what constitutes harm to ecosystems, and whether altered ecosystems are degraded or just different, are disputed (Heink et al., 2018; Hobbs, 2016; Sagoff, 2009), highlighting the crucial distinction between description (positive science) and prescription (normative policy choices). In theory, a clear distinction can (and should) be drawn between the two. For example, it has been argued that distinguishing descriptively between native and alien species has value, but that employing these terms prescriptively can be problematic (Aitken, 2004; Preston, 2009; Warren, 2007, 2009). In practice, however, there is an 'unbearable tension between description and prescription' (Latour, 2017, p. 43) when, because of value commitments, empirical facts appear to demand certain actions. This step from positive scientific description to normative policy prescription – from 'is' to 'ought' – stirs controversy. Such a progression occurs, for example, when a description of an ecosystem's state at some historic moment seamlessly morphs into the vision for how it *should* be, or when change is labeled degradation, implying a need for restoration. The seemingly neutral descriptive adjective 'invasive' is itself a value-laden metaphor freighted with the implication that active resistance is required (Larson, 2018). Policy choices ineluctably stretch beyond science to include value judgments which can be informed but not determined by science (Brown & Sax, 2004, 2005; Frank, 2019; J.H. Lawton, 1997; Sagoff, 2009, 2013, 2018a). Science demonstrates unequivocally that biomes have been transformed into anthromes throughout the world (Ellis, 2015; Russell & Kueffer, 2019), but there is a fundamental divergence over whether such anthropogenically transformed nature can be good nature. Traditional conservation says no. 'New conservation' not only says yes but posits that altered nature might even be better nature for the Anthropocene (Hill & Hadly, 2018; Marris, 2011; Pearce, 2015; Thomas, 2017).

The Anthropocene: A Time to Replace Purism with Pragmatism?

The tension between purist idealism and pragmatic realism runs through many aspects of conservation. However, in one very real sense, events have now put purism out of reach because the onset of the Anthropocene, in which humanity has superseded nature as the dominant environmental force (Ruddiman et al., 2015), represents a rupture in Earth history, a radical discontinuity (C. Hamilton, 2017). Even though the roots of this rupture lie deep in history (Bauer & Ellis, 2018), its global impacts are now writ large, revealing that 'a profound alteration of our relation to the world' has occurred (Latour, 2017, p. 9). In this Anthropocene context of accelerating change, conservation's mission of maintaining ecosystems in their historic state is no longer

possible (Barnosky et al., 2017). The global mixing of species, driven by rapid climate change, human population growth and vast international flows of trade and travel, cannot now be halted, let alone undone (Early et al., 2016; Hulme, 2015). As Lewis and Maslin (2018, p. 274) put it, 'this neobiota living on a new Pangea is our never-to-be-recovered-from legacy. … Naturalized species are now woven into the fabric of nature'. The Garden of Eden has been irretrievably transformed into a 'rambunctious garden' of novel, evolving mixtures (Marris, 2011) such that 'any attempt by humans to keep things just as they are is utterly pointless' (Thomas, 2017, p. 84). Given that permanent eradication of unwanted species is rarely possible at anything other than small scales, trying to turn the tide will merely delay the inevitable and commit substantial resources to never-ending and ultimately unwinnable 'rearguard actions to preserve the *status quo*' (Trudgill, 2008, p. 105). If there is no purity, why be purist?

Moreover, in a rapidly changing world, many species may no longer be well adapted to emerging conditions in their historic ranges, further challenging the equating of 'native' with 'best' (Thomas & Ohlemüller, 2010; Webber & Scott, 2012). It is plausible, therefore, that 'the despised invaders of today may well be the keystone species of the future's ecosystems' (Marris, 2011, p. 109). Pearce (2015) argues that the vigor of invasive alien species should be harnessed, not resisted, because they are demonstrably well suited to the altered and altering ecosystems of the Anthropocene; they are the fittest surviving. Provocatively, he proposes that we should welcome them as nature's salvation. Within this viewpoint, fostering robust, resilient ecosystems comprising species which thrive unaided, whatever their origin, may be the most fruitful strategy for sustaining the wellbeing of both human and non-human communities (G. Hamilton, 2011). Given that the most adaptable and resilient species within novel ecosystems may be aliens, not natives (Inglis, 2020; Schlaepfer et al., 2011), there is a case for learning to love the aliens (Davis, 2009) or – as Robbins and Moore (2012) put it – embracing the monsters. Put simply, an exclusive preference for native species is no longer practicable. Overwhelmed by the countervailing forces of globalization, it is a redundant prescription. In a transformed world, history is of decreasing relevance as a guide for the future because nature has been 'cut loose forever from the prescriptive straitjacket of the past' (Biermann, 2016, p. 217). The concept of 'native' has thus become unusable in the Anthropocene (Hill & Hadly, 2018), necessitating new, future-orientated criteria for determining belonging and value. The altered, hybridized socio-natures of the Anthropocene can no longer act as the 'external' reference point and paragon that 'unspoiled nature' once did because 'when we turn towards the old solid ground of natural law, what do we find? The traces of our action, visible everywhere!' (Latour, 2017, p. 62).

Such arguments underlie numerous calls to abandon the purist pursuit of nativeness in favor of pragmatic realism (Davis et al., 2011; Holl, 2018; Lundgren et al., 2018; Macdonald et al., 2007; Switzer & Angeli, 2016; Thomas, 2017; Warren, 2007, 2011) – to replace 'dogma about native and aliens [with] a sense of proportion and common sense' (Smout, 2014, p. 16). Interestingly, Elton (1958, p. 145) himself adopted a notably more pragmatic approach than the purism enshrined in many of today's conservation policies, believing that the goal of maximizing ecological variety could include aliens, and arguing for 'co-existence between man and nature, even if it has to be a modified kind of man and a modified kind of nature'. This realism is echoed by contemporary advocates of

embracing modified nature, rather than only cherishing imaginary pristine pasts, on the grounds that novel ecosystems may represent the wild lands of the future (Kueffer & Kaiser-Bunbury, 2014; Pearce, 2015). Moreover, the purist, 'nativist' view which underpins conservation laws and targets seems now to be at odds with the views of many scientists, a majority of whom believe that measures of biodiversity should not exclude alien species, and that evaluations should be based on the net impacts of species, not their origins (Gbedomon et al., 2020).

Valorization of 'spoiled nature' destabilizes long-held beliefs about belonging, identity and nature/culture relationships. Re-thinking them requires facing complex, uncomfortable questions about alternative goals, criteria and value frames concerning socio-nature. As Chew and Hamilton (2011, p. 45) observe, 'without nativeness, the ecological past offers us data, but not counsel'. Relinquishing guiding constructions which retain such powerful cultural resonance is disorientating and threatening (Trudgill, 2001). Purism feels like the uncluttered moral high ground; pragmatism smacks of messy surrender. This psycho-cultural reality may partly explain the irony that mounting criticism of the NAC in recent years has coincided with progressive strengthening of conservation frameworks which enshrine this paradigm (Gibbs et al., 2015). It may also be partly explained by the perceived naturalness of nativeness, given that equating natural with good and unnatural with evil is one of the most influential, if flawed, moral frameworks in the history of human thought (Levinovitz, 2020). In due course, the inexorable unfolding of the Anthropocene will surely necessitate pragmatic reform, but for now purism retains its cultural preeminence.

Conclusions

The native/alien paradigm purports to be about flora and fauna, but actually it is all about us – our perceptions and preferences about where other species belong and our ethical judgments about how to treat them. It is about geographies and philosophies of placement and displacement, and the deployment of social constructions of spatial and temporal scale to demarcate moral geographies of belonging and exclusion. As Hattingh (2001, p. 193) puts it, 'the borderlines we draw … to distinguish between that which is "native" and that which is "alien" are therefore in a sense "imaginary" – they are constructed *by us*, by the stories we tell, and they only exist in so far as we choose to continue to tell these stories'. The evidence and arguments reviewed here indicate that it is time to choose to tell different stories that are better aligned with contemporary and future socio-nature, and to stop attempting to make nature conform to a particular 'conception of the way nature ought to be – in defiance of the way nature is' (Sagoff, 2011, p. 81).

To return to the paper's opening emphasis on geography, place-centric approaches to environmental decision-making which are adaptable to local specificities and needs are necessary given the global diversity of both 'natural' and anthropogenic environments (Ellis, 2015), whereas the undifferentiated application of a purist, 'natives first' approach may not best serve the needs of human societies or of our planetary home, as the discussion above has shown. The NAC does not provide settled, scientific and sufficient criteria for evaluating species' worth. On the contrary, it is fluid, contestable and socially constructed (J. Fall, 2005; Head, 2017), as well as being insufficient in the Anthropocene

context of dynamic change (Hill & Hadly, 2018). This does not necessarily render it wholly redundant, but it does question the priority and authority with which it is currently invested. An *a priori* belief that native is always and everywhere best does not withstand scrutiny. What animals and plants *do* matters more than where they came from and how they arrived, so the criteria by which species are valued should be 'outcomes and processes rather than . . . prescribed categories of being' (Head, 2012, p. 174).

Practical and ethical arguments for the outright preservation of native assemblages were already becoming hard to defend three decades ago when Soulé (1990, p. 234) recognized that the 'cosmopolitanization of remnant wildlands' is inevitable and irreversible. He foresaw that policies advocating blanket opposition to all aliens would become ever more expensive, irrational and ultimately counter-productive. Such pragmatism has since developed into an inclusive vision in which most alien species are broadly accepted or even welcomed (Davis et al., 2011; Guiasu & Tindale, 2018; Peretti, 1998; Sagoff, 2005; Stanescu & Cummings, 2017a; Thomas, 2017). This multicultural, cosmopolitan approach does not imply giving in to fatalistic pessimism or *laissez-faire* permissiveness but being realistic and even optimistic, replacing a loss-only outlook with an appreciation of the benefits as well as the challenges of the novel, emerging world. Nor does it mean ignoring the significance of the biogeographic origin of species; the possibility of damaging impacts argues for the inclusion of data about species' origins in management decision-making. It does, however, imply dethroning this criterion from its current preeminent position in assessing value and belonging, and placing it alongside the many other important factors that warrant concern. There is value in understanding dispersal histories, but the use of such information to construct the dominant criterion for valuing and managing non-human species creates collateral damage and confusion. When applied as a 'first-order filter', the NAC is more trouble than it is worth, distorting our vision.

This review therefore concludes that, instead of being employed as a primary arbiter, species' geohistories should be incorporated as one component of a broader evaluative framework – more pragmatic, place-specific, culturally sensitive and impact-focused. This would have a range of advantages, including:

- facilitating evidence-based evaluations of species' impacts – both positive and negative – in the biosocial world as it is and will be, diminishing the twin focus on loss and the past.
- enabling 'good aliens' to be cherished and 'bad natives' to be controlled without any conceptual difficulties.
- reducing the significance of the need for precise definitions of 'native' and 'alien' (because less hangs on the distinction) and the reliance on politically-defined scales of management.
- retaining the value of understanding the biogeographic origins of species for scientific description and understanding, while abandoning the normative use of native/alien labels as primary guides for policy prescription.
- being more congruent with socio-cultural attitudes, helping to foster broad-based support for nature conservation.
- being more flexible to take account of evolving attitudes, contexts and knowledge, and of different biocultural settings.
- reducing the risk of giving offense through language perceived as xenophobic.

- helping to counter human exceptionalism by applying comparable ethical frameworks to both human and ecological communities.

Myths can be comforting and metaphors persuasive, especially when reified. The native/alien framework has been shown to incorporate discredited myths, unfortunate metaphors and slippery definitions. In the Anthropocene, it no longer warrants its place as a ruling paradigm guiding conservation management and valuations of non-human nature but should take its place as simply one consideration amongst many which shape the rapidly evolving moral geographies of biocultural relationships. Ideals of 'good' nature should not be restricted to native natures defined with reference to an increasingly irrelevant past.

Notes

1. But see Soulé (1990) and Gould (1998) for examples of early critiques by leading ecologists.
2. The terms 'non-native', 'exotic' and 'introduced' are also frequently used interchangeably with 'alien'. These labels respectively emphasize alien species' unnaturalness, their distant place of origin and the human agency involved.
3. See, for example, the public exchanges between Sagoff (1999, 2005) and Simberloff (2003, 2005); Warren (2007, 2008, 2009) and Richardson et al. (2008) and Preston (2009); Davis et al. (2011) and Simberloff (2011a) (representing 141 invasion biologists); Valéry et al. (2013) and Simberloff and Vitule (2014); Hoffman and Courchamp (2016) and Wilson et al. (2016); Guiasu and Tindale (2018) and Frank et al. (2019). There have even been repeated calls for the end of invasion biology itself (Davis, 2009; Sagoff, 2018a; Theodoropoulos, 2003; Valéry et al., 2013).

Acknowledgments

Constructive critical input from Dan Clayton, Ken Thompson and two anonymous referees improved the manuscript.

Disclosure Statement

No potential conflict of interest was reported by the author(s).

ORCID

Charles R. Warren http://orcid.org/0000-0003-4449-4068

References

Aitken, G. (2004). *A new approach to conservation: The importance of the individual through wildlife rehabilitation*. Ashgate.

Anthony, L. (2017). *The aliens among us: How invasive species are transforming the planet - and ourselves*. Yale University Press.

Antonsich, M. (2020). Natives and aliens: Who and what belongs in nature and in the nation? *Area, 2020*, 1–8. doi:10.1111/area.12679.

Bach, T. M. (2019). From killing lists to healthy country: Aboriginal approaches to weed control in the Kimberley, Western Australia. *Journal of Environmental Management*, *229(1)*, 182–192. https://doi.org/10.1016/j.jenvman.2018.06.050

Barnosky, A. D., Hadly, E. A., Gonzalez, P., Head, J., & 37 others. (2017). Merging paleobiology with conservation biology to guide the future of terrestrial ecosystems. *Science, 355*(6325), eaah4787. doi:10.1126/science.aah4787.

Barras, C. (2019). The end of species. *New Scientist*, *241*(3214), 36–39. https://doi.org/10.1016/S0262-4079(19)30165-4

Bauer, A. M., & Ellis, E. C. (2018). The Anthropocene divide: Obscuring understanding of social-environmental change. *Current Anthropology*, *59*(2), 209–227. https://doi.org/10.1086/697198

Bhattacharyya, J., & Larson, B. M. H. (2014). The need for indigenous voices in discourse about introduced species: Insights from a controversy over wild horses. *Environmental Values*, *23*(6), 663–684. https://doi.org/10.3197/096327114X13947900181031

Biermann, C. (2016). Securing forests from the scourge of chestnut blight: The biopolitics of nature and nation. *Geoforum*, *75*, 210–219. https://doi.org/10.1016/j.geoforum.2016.07.007

Boltovskoy, D., Sylvester, F., & Paolucci, E. M. (2018). Invasive species denialism: Sorting out facts, beliefs, and definitions. *Ecology and Evolution*, *8*(22), 11190–11198. https://doi.org/10.1002/ece3.4588

Boonman-Berson, S., Turnhout, E., & van Tatenhove, J. (2014). Invasive species: The categorization of wildlife in science, policy, and wildlife management. *Land Use Policy*, *38*, 204–212. https://doi.org/10.1016/j.landusepol.2013.11.002

Brennan, R. E. (2018). The conservation 'myths' we live by: Reimagining human-nature relationships within the Scottish marine policy context. *Area*, *50*(2), 159–168. https://doi.org/10.1111/area.12420

Briggs, J. C. (2017). Rise of invasive species denialism? A response to Russell and Blackburn. *Trends in Ecology & Evolution*, *32*(4), 231–232. https://doi.org/10.1016/j.tree.2017.02.003

Brown, J. H., & Sax, D. F. (2004). An essay on some topics concerning invasive species. *Austral Ecology*, *29*(5), 530–536. https://doi.org/10.1111/j.1442-9993.2004.01340.x

Brown, J. H., & Sax, D. F. (2005). Biological invasions and scientific objectivity: Reply to Cassey *et al*. (2005). *Austral Ecology*, *30*(4), 481–483. https://doi.org/10.1111/j.1442-9993.2005.01504.x

Brown, N. (1997). Re-defining native woodland. *Forestry*, *70*(3), 191–198. https://doi.org/10.1093/forestry/70.3.191

Buckley, Y. M., & Catford, J. (2016). Does the biogeographic origin of species matter? Ecological effects of native and non-native species and the use of origin to guide management. *Journal of Ecology*, *104*(1), 4–17. https://doi.org/10.1111/1365-2745.12501

Callicott, J. B. (2002). Choosing appropriate spatial and temporal scales for ecological restoration. *Journal of Biosciences*, *27*(4), 410–420. https://doi.org/10.1007/BF02704969

Caluya, G. (2014). Fragments for a postcolonial critique of the Anthropocene: Invasion biology and environmental security. In J. Frawley & I. McCalman (Eds.), *Rethinking invasion ecologies from the environmental humanities* (pp. 31–44). Routledge.

Camus, J. Y. (2021). The dark side of green. *RSA Journal*, *2021*(2), 44–46.

Carey, M. P., Sanderson, B. L., Barnas, K. A., & Olden, J. D. (2012). Native invaders - challenges for science, management, policy and society. *Frontiers in Ecology and the Environment*, *10*(7), 373–381. https://doi.org/10.1890/110060

Castree, N. (2005). *Nature*. Routledge.

Castree, N. (2014). *Making sense of nature: Representation, politics and democracy*. Routledge.

Chew, M. (2009). The monstering of tamarisk: How scientists made a plant into a problem. *Journal of the History of Biology*, *42*(2), 231–266. https://doi.org/10.1007/s10739-009-9181-4

Chew, M. (2011). Anekeitaxonomy: Botany, Place and Belonging. In I. D. Rotherham, & R. A. Lambert (Eds.), *Invasive and Introduced Plants and Animals: Human Perceptions, Attitudes and Approaches to Management* (pp. 137–152). Earthscan.

Chew, M. K., & Hamilton, A. L. (2011). The rise and fall of biotic nativeness: A historical perspective. In D. M. Richardson (Ed.), *Fifty years of invasion ecology: The legacy of charles elton* (pp. 35–47). Wiley-Blackwell.

Chew, M. K. (2015). Ecologists, environmentalists, experts and the invasion of the 'Second Greatest Threat'. *International Review of Environmental History*, *1(1)*, 17–40. https://doi.org/10.22459/IREH.01.2015.02

Chew, M. K., & Laubichler, M. D. (2003). Natural enemies - metaphor or misconception? *Science*, *301* (5629), 52–53. https://doi.org/10.1126/science.1085274

Clark, J. L. (2015). Uncharismatic invasives. *Environmental Humanities*, *6*(1), 29–52. https://doi.org/10.1215/22011919-3615889

Clayton, S., & Myers, G. (2009). *Conservation Psychology:understanding and promoting human care for nature*. Wiley-Blackwell.

Coates, P. (2011). Over here: American animals in Britain. In I. D. Rotherham & R. A. Lambert (Eds.), *Invasive and introduced plants and animals: Human perceptions, attitudes and approaches to management* (pp. 39–54). Earthscan.

Coates, P. (2015). A tale of two squirrels: A British case study of the sociocultural dimensions of debates over invasive species. In R. P. Keller, M. W. Cadotte, & G. Sandiford (Eds.), *Invasive species in a globalized world: Ecological, social and legal perspectives on policy* (pp. 44–71). University of Chicago Press.

Colautti, R. I., & MacIsaac, H. J. (2004). A neutral terminology to define 'invasive' species. *Diversity and Distribution*, *10*(2), 135–141. https://doi.org/10.1111/j.1366-9516.2004.00061.x

Corlett, R. T. (2015). The Anthropocene concept in ecology and conservation. *Trends in Ecology & Evolution*, *30*(1), 36–41. https://doi.org/10.1016/j.tree.2014.10.007

Courchamp, F., Fournier, A., Bellard, C., Bertelsmeier, C., Bonnaud, E., Jeschke, J. M., & Russell, J. C. (2017). Invasion biology: Specific problems and possible solutions. *Trends in Ecology & Evolution*, *32*(1), 13–22. https://doi.org/10.1016/j.tree.2016.11.001

Cowan, P., & Warburton, B. (2011). Animal welfare and ethical issues in island pest eradication. In C. Veitch, M. Clout, & D. R. Towns (Eds.), *Island invasives: Eradication and management* (pp. 418–421). IUCN.

Crees, J. J., & Turvey, S. T. (2015). What constitutes a 'native' species? Insights from the quaternary faunal record. *Biological Conservation*, *186*, 143–148. https://doi.org/10.1016/j.biocon.2015.03.007

Cresswell, T. (1997). Weeds, plagues, and bodily secretions: A geographical interpretation of metaphors of displacement. *Annals of the Association of American Geographers*, *87*(2), 330–345. https://doi.org/10.1111/0004-5608.872056

Crowley, S., Hinchliffe, S., & McDonald, R. (2017a). Conflict in invasive species management. *Frontiers in Ecology and the Environment*, *15*(3), 133–141. https://doi.org/10.1002/fee.1471

Crowley, S., Hinchliffe, S., Redpath, S. M., & McDonald, R. A. (2017b). Disagreement about invasive species does not equate to denialism: A response to Russell and Blackburn. *Trends in Ecology & Evolution*, *32*(4), 229–230. https://doi.org/10.1016/j.tree.2017.02.004

Culotta, E. (2012). Roots of racism. *Science*, *336*(6083), 825–827. https://doi.org/10.1126/science.336.6083.825

Davis, M. A. (2009). *Invasion biology*. Oxford University Press.

Davis, M. A., & Chew, M. K. (2017). 'The denialists are coming!' Well, not exactly: A response to Russell and Blackburn. *Trends in Ecology & Evolution*, *32*(4), 228–229. https://doi.org/10.1016/j.tree.2017.02.008

Davis, M. A., Chew, M. K., Hobbs, R. J., Lugo, A. E., Ewel, J. J., Vermeij, G. J., Brown, J. H., Rosenzweig, M. L., Gardener, M. R., Carroll, S. P., Thompson, K., Pickett, S. T. A., Stromberg, J. C., Tredici, P. D., Suding, K. N., Ehrenfeld, J. G., Philip Grime, J., Mascaro, J., & Briggs, J. C. (2011). Don't judge species on their origins. *Nature*, *474*(7350), 153–154. https://doi.org/10.1038/474153a

Denevan, W. M. (2011). The 'pristine myth' revisited. *Geographical Review*, *101*(4), 576–591. https://doi.org/10.1111/j.1931-0846.2011.00118.x

Diagne, C., Leroy, B., Vaissière, A.-C., Gozlan, R. C., Roiz, D., Jarić, I., Salles, J.-M., Bradshaw, C. J. A., & Courchamp, F. (2021). High and rising economic costs of biological invasions worldwide. *Nature*, *592*(7855), 571–576. https://doi.org/10.1038/s41586-021-03405-6

Didham, R. K., Tylianakis, J. M., Hutchinson, M. A., Ewers, R. M., & Gemmell, N. J. (2005). Are invasive species the drivers of ecological change? *Trends in Ecology & Evolution*, *20*(9), 470–474. https://doi.org/10.1016/j.tree.2005.07.006

Dornelas, M., Gotelli, N. J., McGill, B., Shimadzu, H., Moyes, F., Sievers, C., & Magurran, A. (2014). Asssemblage time series reveal biodiversity change but not systematic loss. *Science*, *344*(6181), 296–299. https://doi.org/10.1126/science.1248484

Dueñas, M. A., Ruffhead, H. J., Wakefield, N. H., Roberts, P. D., Hemming, D. J., & Diaz-Soltero, H. (2018). The role played by invasive species in interactions with endangered and threatened species in the United States: A systematic review. *Biodiversity and Conservation*, *27*(12), 3171–3183. https://doi.org/10.1007/s10531-018-1595-x

Dunn, M., Marzano, M., Forster, J., & Gill, R. M. A. (2018). Public attitudes towards 'pest' management: perceptions on squirrel management strategies in the UK. *Biological Conservation, 222*, 52–63. https://doi.org/10.1016/j.biocon.2018.03.020\

Early, R., Bradley, B. A., Dukes, J. S., Lawler, J. J., Olden, J. D., Blumenthal, D. M., Gonzalez, P., Grosholz, E. D., Ibañez, I., Miller, L. P., Sorte, C. J. B., & Tatem, A. J. (2016). Global threats from invasive alien species in the twenty-first century and national response capacities. *Nature Communications*, *7*, 12485–9. https://doi.org/10.1038/ncomms12485

Ellis, E. C. (2015). Ecology in an Anthropogenic biosphere. *Ecological Monographs*, *85*(3), 287–331. https://doi.org/10.1890/14-2274.1

Elton, C. S. (1958). *The ecology of invasions by animals and plants*. Methuen.

Essl, F., Bacher, S., Genovesi, P., Hulme, P. E., Jeschke, J. M., Katsanevakis, S., Kowarik, I., Kühn, I., Pyšek, P., Rabitsch, W., Schindler, S., van Kleunen, M., Vilà, M., Wilson, J. R. U., & Richardson, D. M. (2018). Which taxa are alien? Criteria, applications, and uncertainties. *BioScience*, *68*(7), 496–509. https://doi.org/10.1093/biosci/biy057

Essl, F., Hulme, P. E., Jeschke, J. M., Reuben, K., Pyšek, P., Richardson, D. M., Saul, W. C., Bacher, S., Dullinger, S., Estévez, R. A., Kueffer, C., Roy, H. E., Seebens, H., Rabitsch, W. et al (2017). Scientific and normative foundations for the valuation of alien-species impacts: Thirteen core principles. *BioScience*, *67*(2), 166–178. https://doi.org/10.1093/biosci/biw160

Estévez, R. A., Anderson, C. B., Pizarro, C., & Burgman, M. A. (2014). Clarifying values, risk perceptions, and attitudes to resolve or avoid social conflicts in invasive species management. *Conservation Biology*, *29*(1), 19–30. https://doi.org/10.1111/cobi.12359

Ewel, J. J., & Putz, F. E. (2004). A place for alien species in ecosystem restoration. *Frontiers in Ecology and the Environment*, *2*(7), 354–360. https://doi.org/10.1890/1540-9295(2004)002[0354:APFASI]2.0.CO;2

Fall, J. (2005). *Drawing the Line: Nature, hybridity and politics in transboundary spaces*. Ashgate.

Fall, J. J. (2014a). Governing mobile species in a climate-changed world. In J. Stripple & H. Bulkeley (Eds.), *Governing the climate: New approaches to rationality, power and politics* (pp. 160–174). Cambridge University Press.

Fall, J. J. (2014b). Biosecurity and ecology: Beyond the nativist debate. In K. Barker, A. Dobson, & S. Taylor (Eds.), *Biosecurity: The socio-politics of invasive species and infectious diseases* (pp. 167–181). Earthscan.

Frank, D. M. (2019). Disagreement or denialism? 'Invasive species denialism' and ethical disagreement in science. *Synthese*. https://doi.org/10.1007.s11229-019-02259-w

Frank, D. M., Simberloff, D., Bush, J., Chuang, A., & Leppanen, C. (2019). Logical fallacies and reasonable debates in invasion biology: A response to Guiasu and Tindale. *Biology & Philosophy*, *34:49*(5). https://doi.org/10.1007/s10539-019-9704-0

Futhazar, G. (2020). The conceptual challenges of invasive alien species to non-human rights. *Journal of Human Rights and the Environment*, *11*(2), 224–243. https://doi.org/10.4337/jhre.2020.02.04

Gbedomon, R. C., Salako, V. K., & Schlaepfer, M. A. (2020). Diverse views among scientists on non-native species. *NeoBiota*, *54*, 49–69. https://doi.org/10.3897/neobiota.54.38741

Gibbs, L., Atchison, J., & Macfarlane, I. (2015). Camel country: Assemblage, belonging and scale in invasive species geographies. *Geoforum*, *58*, 56–67. https://doi.org/10.1016/j.geoforum.2014.10.013

Gillson, L. (2015). *Biodiversity conservation and environmental change: Using palaeoecology to manage dynamic landscapes in the Anthropocene*. Oxford University Press.

Gilroy, J. J., Avery, J. D., & Lockwood, J. L. (2017). Seeking international agreement on what it means to be 'native'. *Conservation Letters*, *10*(2), 238–247. https://doi.org/10.1111/conl.12246

Goodenough, A. E. (2010). Are the ecological impacts of alien species misrepresented? A review of the 'native good, alien bad' philosophy. *Community Ecology*, *11*(1), 13–21. https://doi.org/10.1556/ComEc.11.2010.1.3
Gould, S. J. (1998). An evolutionary perspective on strengths, fallacies, and confusions in the concept of native plants. *Arnoldia*, *58*(1), 2–10.
Gröning, G., & Wolschke-Bulmahn, J. (2003). The native plant enthusiasm: Ecological panacea or xenophobia? *Landscape Research*, *28*(1), 75–88. https://doi.org/10.1080/01426390306536
Guerin, G. R. (2019). Invoking denialism does not strengthen invasion science. *Biodiversity and Conservation*, *28*(7), 1939–1941. https://doi.org/10.1007/s10531-019-01763-2
Guerin, G. R., Martín-Forés, I., Sparrow, B., & Lowe, A. J. (2018). The biodiversity impacts of non-native species should not be extrapolated from biased single-species studies. *Biodiversity Conservation*, *27*(3), 785–790. https://doi.org/10.1007/s10531-017-1439-0
Guiasu, R. C. (2016). *Non-native species and their role in the environment: The need for a broader perspective*. Brill.
Guiasu, R. C., & Tindale, C. W. (2018). Logical fallacies and invasion biology. *Biology & Philosophy*, *33* (5–6), 5–6. https://doi.org/org/10.1007/s10539-018-9644-0
Gurevitch, J., & Padilla, D. K. (2004). Are invasive species a major cause of extinctions? *Trends in Ecology & Evolution*, *19*(9), 470–474. https://doi.org/10.1016/j.tree.2004.07.005
Hamilton, C. (2017). *Defiant earth: The fate of humans in the Anthropocene*. Polity Press.
Hamilton, G. (2011). Aliens to the rescue. *New Scientist*, *209*(2795), 34–37. https://doi.org/10.1016/S0262-4079(11)60103-6
Hartman, L. M., & Wooley, K. M. (2020). The good, the wild and the native: An ethical evaluation of ecological restoration, native landscaping, and the 'Wild Ones' of Wisconsin. *Environmental Values*, *29*(5), 579–603. https://doi.org/10.3197/096327120X15868540131279
Hattingh, J. (2001). Human dimensions of invasive alien species issues in philosophical perspective: Towards an ethic of conceptual responsibility. In J. A. McNeely (Ed.), *The great reshuffling: Human dimensions of invasive alien species* (pp. 183–194). IUCN.
Head, L. (2000). *Cultural landscapes and environmental change*. Arnold.
Head, L. (2008). Is the concept of human impacts past its use-by date? *The Holocene,18*(3), 373–377. https://doi.org/10.1177/0959683607087927
Head, L. (2012). Decentring 1788: Beyond biotic nativeness. *Geographical Research*, *50*(2), 166–178. https://doi.org/10.1111/j.1745-5871.2011.00746.x
Head, L. (2014). Living in a weedy future: Insights from the garden. In J. Frawley & I. McCalman (Eds.), *Rethinking invasion ecologies from the environmental humanities* (pp. 87–99). Routledge.
Head, L. (2015). The Anthropoceneans. *Geographical Research*, *53*(3), 313–320. https://doi.org/10.1111/1745-5871.12124
Head, L. (2017). The social dimensions of invasive plants. *Nature Plants*, *3*(6), 1–7. https://doi.org/10.1038/nplants.2017.75
Head, L., & Muir, P. (2004). Nativeness, invasiveness, and nation in Australian plants. *Geographical Review*, *94*(2), 199–217. https://doi.org/10.1111/j.1931-0846.2004.tb00167.x
Heink, U., Van Herzele, A., Bela, G., Kalóczkai, Á., & Jax, K. (2018). Different arguments, same conclusions: How is action against invasive alien species justified in the context of European policy? *Biodiversity Conservation*, *27*(7), 1659–1677. https://doi.org/10.1007/s10531-016-1170-2
Hettinger, N. (2001). Exotic species, naturalisation and biological nativism. *Environmental Values*, *10* (2), 193–224. https://doi.org/10.3197/096327101129340804
Hettinger, N. (2021). Understanding and defending the preference for native species. In B. Bovenkerk & J. Keulartz (Eds.), *Animals in our midst: The challenges of co-existing with animals in the Anthropocene* (pp. 399–424). Springer.
Hill, A. P., & Hadly, E. A. (2018). Rethinking 'native' in the Anthropocene. *Frontiers in Earth Science*, *6*, 1–4. https://doi.org/10.3389/feart.2018.00096
Hobbs, R. J. (2016). Degraded or just different? Perceptions and value judgements in restoration decisions. *Restoration Ecology*, *24*(2), 153–158. https://doi.org/10.1111/rec.12336

Hobbs, R. J., Higgs, E., & Harris, J. A. (2009). Novel ecosystems: Implications for conservation and restoration. *Trends in Ecology & Evolution*, *24*(11), 599–605. https://doi.org/10.1016/j.tree.2009.05.012

Hoffman, B. D., & Courchamp, F. (2016). Biological invasions and natural colonisations: Are they that different? *NeoBiota*, *29*, 1–14. https://doi.org/10.3897/neobiota.29.6959

Holl, K. (2018). Beech and sycamore in Scotland's native woods - a way forward? *Scottish Forestry*, *72* (1), 41–45.

Hulme, P. E. (2015). Invasion pathways at a crossroad: Policy and research challenges for managing alien species introductions. *Journal of Applied Ecology*, *52*(6), 1418–1424. https://doi.org/10.1111/1365-2664.12470

Humair, F., Edwards, P. J., Siegrist, M., & Kueffer, C. (2014). Understanding misunderstandings in invasion science: Why experts don't agree on common concepts and risk assessments. *NeoBiota*, *20*, 1–30. https://doi.org/10.3897/neobiota.20.6043

Inglis, M. I. (2020). Wildlife ethics and practice: Why we need to change the way we talk about 'invasive species'. *Journal of Agricultural & Environmental Ethics*, *33*(2), 299–313. https://doi.org/10.1007/s10806-020-09825-0

Inkpen, S. A. (2017). Are humans disturbing conditions in ecology? *Biology & Philosophy*, *32*(1), 51–71. https://doi.org/10.1007/s10539-016-9537-z

Jelinski, D. E. (2010). On the notions of mother nature and the balance of nature and their implications for conservation. In D. G. Bates & J. Tucker (Eds.), *Human ecology: Contemporary research and practice (pp. 37-50)*. Springer.

Kapitza, K., Zimmermann, H., Martín-López, B., & Wehrden, H. (2019). Research on the social perception of invasive species: A systematic literature review. *NeoBiota*, *43*, 47–68. https://doi.org/10.3897/neobiota.43.31619

Kareiva, P., & Marvier, M. (2018). Uncomfortable questions and inconvenient data in conservation science. In P. Kareiva, M. Marvier, & B. Silliman (Eds.), *Effective conservation science: Data not dogma* (pp. 3–9). Oxford University Press.

Katz, E. (2014). The Nazi comparison in the debate over restoration: Nativism and domination. *Environmental Values*, *23*(4), 377–398. https://doi.org/10.3197/096327114X13947900181554

Keller, R. P., Cadotte, M. W., & Sandiford, G. (*eds*). (2015). *Invasive species in a globalized world: Ecological, social and legal perspectives on policy*. University of Chicago Press.

Kendle, A. D., & Rose, J. E. (2000). The aliens have landed! What are the justifications for 'native only' policies in landscape plantings? *Landscape and Urban Planning*, *47*(1–2), 19–31. https://doi.org/10.1016/S0169-2046(99)00070-5

Keulartz, J. (2007). Using metaphors in restoring nature. *Nature and Culture*, *2*(1), 27–48. https://doi.org/10.3167/nc.2007.020103

Keulartz, J., & van der Weele, C. N. (2009). Between nativism and cosmopolitanism: Framing and reframing in invasion biology. In M. Drenthen, F. Keulartz, & J. Proctor (Eds.), *New visions of nature* (pp. 237–256). Springer.

Kim, C. (2015). *Dangerous crossings: Race, species, and nature in a multicultural age*. Cambridge University Press.

Knights, P. (2008). Native species, human communites and cultural relationships. *Environmental Values*, *17*(3), 353–373. https://doi.org/10.3197/096327108X343121

Kuebbing, S. E., & Simberloff, D. (2015). Missing the bandwagon: Nonnative species impacts still concern managers. *NeoBiota*, *25*, 73–86. https://doi.org/10.3897/neobiota.25.8921

Kueffer, C., & Kull, C. A. (2017). Non-native species and the aesthetics of nature. In M. Vilá & P. E. Hulme (Eds.), *Impact of biological invasions on ecosystem services* (Vol. 12, pp. 311–324). Springer Series in Invasion Ecology.

Kueffer, C., & Kaiser-Bunbury, C. N. (2014). Reconciling conflicting perspectives for bidiversity conservation in the Anthropocene. *Frontiers in Ecology and the Environment*, *12*(2), 131–137. https://doi.org/10.1890/120201

Kueffer, C., & Larson, B. M. H. (2014). Responsible use of language in scientific writing and science communication. *Bioscience*, *64*(8), 719–724. https://doi.org/10.1093/biosci/biu084

Kunz, W. (2013). *Do species exist? Principles of taxonomic classification*. Wiley.

Larson, B. (2011). *Metaphors for environmental sustainability: Redefining our relationship with nature*. Yale University Press.
Larson, B. (2018). Environmental metaphor. In N. Castree, M. Hulme, & J. D. Proctor (Eds.), *Companion to environmental studies* (pp. 645–648). Routledge.
Latour, B. (2017). *Facing gaia: Eight lectures on the new climatic regime*. Polity.
Lawton, G. (2019). The rise of real eco-fascism. *New Scientist*, *243*(3243), 24.
Lawton, J. H. (1997). The science and non-science of conservation biology. *Oikos*, *79*(1), 3–5. https://doi.org/10.2307/3546084
Levinovitz, A. (2020). *Natural: The seductive myth of nature's goodness*. Profile Books.
Lewis, S. L., & Maslin, M. A. (2018). *The human planet: How we created the Anthropocene*. Pelican Books.
Linklater, W., & Steer, J. (2018). Predator free 2050: A flawed conservation policy displaces higher priorities and better, evidence-based alternatives. *Conservation Letters*, *11*(6), e12593. https://doi.org/10.1111/conl.12593
Linnell, J. D. C. (2015). Defining scales for managing biodiversity and natural resources in the face of conflicts. In S. M. Redpath, J. R. Gutiérrez, K. A. Wood, & J. C. Young (Eds.), *Conflicts in conservation: Navigating towards solutions* (pp. 212–222). Cambridge University Press.
Lockwood, J. A., & Latchininsky, A. V. (2008). Philosophical justifications for the extirpation of non-indigenous species: The case of the grasshopper *Schistocerca nitens* (Orthoptera) on the Island of Nihoa, Hawaii. *Journal of Insect Conservation*, *12(3-4)*, 235–251.
Lodge, D. M., & Shrader-Frechette, K. (2003). Nonindigenous species: Ecological explanation, environmental ethics, and public policy. *Conservation Biology*, *17*(1), 31–37. https://doi.org/10.1046/j.1523-1739.2003.02366.x
Lundgren, E., Ramp, D., Ripple, W., & Wallach, A. (2018). Introduced megafauna are rewilding the Anthropocene. *Ecography*, *41*(6), 857–866. https://doi.org/10.1111/ecog.03430
Lyons, S. K., Amatangelo, K. L., Behrensmeyer, A. K., Bercovici, A., Blois, J. L., Davis, M., DiMichele, W. A., Du, A., Eronen, J. T., Faith, J. T., Graves, G. R., Jud, N., Labandeira, C., Looy, C. V., McGill, B., Miller, J. H., Patterson, D., Pineda-Munoz, S., Potts, R., Riddle, B., Terry, R., Tóth, A., Ulrich, W., Villaseñor, A., Wing, S., Anderson, H., Anderson, J., Waller, D., & Gotelli, N. J. et al. (2015). Holocene shifts in the assembly of plant and animal communities implicate human impacts. *Nature*, *528*(7582), 1–4. doi:10.1038/nature16447.
Macdonald, D. W., King, C. M., & Strachan, R. (2007). Introduced species and the line between biodiversity conservation and naturalistic eugenics. In D. W. Macdonald & K. Service (Eds.), *Key topics in conservation biology* (pp. 186–205). Blackwell.
Marris, E. (2011). *Rambunctious garden: Saving nature in a post-wild world*. Bloomsbury.
Marston, S. A. (2000). The social construction of scale. *Progress in Human Geography*, *24*(2), 219–242. https://doi.org/10.1191/030913200674086272
Mastnak, T., Elyachar, J., & Boellstorff, T. (2014). Botanical decolonization: Rethinking native plants. *Environment and Planning. D, Society & Space*, *32*(2), 363–380. https://doi.org/10.1068/d13006p
Maxwell, S. L., Fuller, R. A., Brooks, T. M., & Watson, J. E. M. (2016). The ravages of guns, nets and bulldozers. *Nature*, *536*(7615), 143–145. https://doi.org/10.1038/536143a
McNeely, J. A. (Ed.). (2001). *The Great Reshuffling:Human Dimensions of Invasive Alien Species*. IUCN.
Meyerson, L. A., Carlton, J. T., Simberloff, D., & Lodge, D. M. (2019). The growing peril of biological invasions. *Frontiers in Ecology and the Environment*, *17*(4), 191. https://doi.org/10.1002/fee.2036
Morris, M. C. (2020). Predator-free New Zealand and the 'war' on pests: Is it a just war? *Journal of Agricultural & Environmental Ethics*, *33*(1), 93–110. https://doi.org/10.1007/s10806-019-09815-x
Munro, D., Steer, J., & Linklater, W. (2019). On allegations of invasive species denialism. *Conservation Biology*, *33*(4), 797–802. https://doi.org/10.1111/cobi.13278
O'Brien, W. (2006). Exotic invasions, nativism, and ecological restoration: On the persistence of a contentious debate. *Ethics, Place and Environment*, *9*(1), 63–77. https://doi.org/10.1080/13668790500512530
Olwig, K. R. (2003). Natives and aliens in the national landscape. *Landscape Research, 28*(1), 61–74. https://doi.org/10.1080/01426390306525
Owens, B. (2017). The big cull. *Nature, 541*(7636), 148–150.

Pearce, F. (2015). *The new wild: Why invasive species will be nature's salvation*. Faber and Faber.
Peretti, J. H. (1998). Nativism and nature: Rethinking biological invasion. *Environmental Values*, *7*(2), 183–192. https://doi.org/10.3197/096327198129341537
Pimentel, D. (2011). *Biological invasions: Economic and environmental costs of alien plant, animal, and microbe species*. 2nd ed. CRC Press.
Poe, S., & Latella, I. M. (2018). Empirical test of the native–nonnative distinction: Native and nonnative assemblages of Anolis lizards are similar in morphology and phylogeny. *Functional Ecology*, *32*(11), 2553–2561. https://doi.org/10.1111/1365-2435.13185
Preston, C. D. (2009). The terms 'native' and 'alien' - a biogeographical perspective. *Progress in Human Geography*, *33*(5), 702–711. https://doi.org/10.1177/0309132508105002
Prévot-Julliard, A.-C., Clavel, J., Teillac-Deschamps, P., & Julliard, R. (2011). The need for flexibility in conservation practices: Exotic species as an example. *Environmental Management*, *47*(3), 315–321. https://doi.org/10.1007/s00267-011-9615–6
Primack, R. B., Miller-Rushing, A. J., Corlett, R. T., Devictor, V., Johns, D. M., Loyola, R., Maas, B., Pakeman, R. J., & Pejchar, L. (2018). Biodiversity gains? The debate on changes in local- vs global-scale species richness. *Biological Conservation*, *219*, A1–A3. https://doi.org/10.1016/j.biocon.2017.12.023
Purdy, J. (2018). *After nature: A politics for the Anthropocene*. Harvard University Press.
Qvenild, M. (2014). Wanted and unwanted nature: Landscape development at Fornebu, Norway. *Journal of Environmental Policy and Planning*, *16*(2), 183–200. https://doi.org/10.1080/1523908X.2013.829747
Radomski, P., & Perleberg, D. (2019). Avoiding the invasive trap: Policies for aquatic non-indigenous plant management. *Environmental Values*, *28*(3), 211–232. https://doi.org/10.3197/096327119X15515267418539
Ricciardi, A., & Ryan, R. (2018). The exponential growth of invasive species denialism. *Biological Invasions*, *20*(3), 549–553. https://doi.org/10.1007/s10530-017-1561-7
Richardson, D. M., Pyšek, P., Simberloff, D., Rejmánek, M., & Mader, A. D. (2008). Biological invasions - the widening debate: A response to Charles Warren. *Progress in Human Geography*, *32*(2), 295–298. https://doi.org/10.1177/0309132507088313
Richardson, D. M., & Ricciardi, A. (2013). Misleading criticisms of invasion science: A field guide. *Diversity & Distributions*, *19*(12), 1461–1467. https://doi.org/10.1111/ddi.12150
Robbins, P. (2004). Comparing invasive networks: Cultural and political biographies of invasive species. *The Geographical Review*, *94*(2), 139–156. https://doi.org/10.1111/j.1931-0846.2004.tb00164.x
Robbins, P., & Moore, S. A. (2012). Ecological anxiety disorder: Diagnosing the politics of the Anthropocene. *Cultural Geographies*, *20*(1), 3–19. https://doi.org/10.1177/1474474012469887
Rotherham, I. D., & Lambert, R. A. (*eds*). (2011). *Invasive and introduced plants and animals: Human perceptions, attitudes and approaches to management*. Earthscan.
Ruddiman, W. F. E., Ellis, E. C., Kaplan, J. O., & Fuller, D. Q. (2015). Defining the epoch we live in: Is a formally designated 'Anthropocene' a good idea? *Science*, *348*(6230), 38–39. https://doi.org/10.1126/science.aaa7297
Russell, J. C., & Blackburn, T. M. (2017). The rise of invasive species denialism. *Trends in Ecology & Evolution*, *32*(1), 3–6. https://doi.org/10.1016/j.tree.2016.10.012
Russell, J. C., & Kueffer, C. (2019). Island biodiversity in the Anthropocene. *Annual Review of Environment and Resources*, *44*(1), 31–60. https://doi.org/10.1146/annurev-environ-101718-033245
Sagoff, M. (1999). What's wrong with exotic species? *Report from the Institute for Philosophy & Public Policy*, *19*(4), 16–23.
Sagoff, M. (2005). Do non-native species threaten the natural environment? *Journal of Agricultural & Environmental Ethics*, *18*(3), 215–236. https://doi.org/10.1007/s10806-005-1500-y
Sagoff, M. (2009). Environmental harm: Political not biological. *Journal of Agricultural & Environmental Ethics*, *22*(1), 81–88. https://doi.org/10.1007/s10806-008-9127-4

Sagoff, M. (2011). Who is the invader? Alien species, property rights and the police power. In I. D. Rotherham & R. A. Lambert (Eds.), *Invasive and introduced plants and animals: Human perceptions, attitudes and approaches to management* (pp. 81–108). Earthscan.
Sagoff, M. (2013). What does environmental protection protect? *Ethics, Policy and Environment*, *16*(3), 239–257. https://doi.org/10.1080/21550085.2013.843362
Sagoff, M. (2018a). What is invasion biology? *Ecological Economics*, *154(C)*, 22–30. https://doi.org/10.1016/j.ecolecon.2018.07.023
Sagoff, M. (2018b). Invasive species denialism: A reply to Ricciardi and Ryan. *Biological Invasions*, *20* (10), 2723–2729. https://doi.org/10.1007/s10530-018-1752-x
Sagoff, M. (2020). Fact and value in invasion biology. *Conservation Biology*, *34*(3), 581–588. https://doi.org/10.1111/cobi.13440
Salisbury, E. (1961). *Weeds and aliens*. Collins.
Sandiford, G., Keller, R. P., & Cadotte, M. (2015). Final thoughts: Nature and human nature. In R. P. Keller, M. W. Cadotte, & G. Sandiford (Eds.), *Invasive species in a globalized world: Ecological, social and legal perspectives on policy* (pp. 381–394). University of Chicago Press.
Schlaepfer, M., Sax, D. F., & Olden, J. D. (2011). The potential conservation value of non-native species. *Conservation Biology*, *25*(3), 428–437. https://doi.org/10.1111/j.1523-1739.2010.01646.x
Schlaepfer, M. A. (2018a). Do non-native species contribute to biodiversity? *PLoS Biology*, *16*(4), e2005568. https://doi.org/10.1371/journal.pbio.2005568
Schlaepfer, M. A. (2018b). Introduced species are not always the enemy of conservation. In P. Kareiva, M. Marvier, & B. Silliman (Eds.), *Effective conservation science: Data not dogma* (pp. 39–44). Oxford University Press.
Schmitt, C. R. (2017). Paradise and warfare: Aldo Leopold and the rhetorical origins of restoration ecology. In J. Stanescu & K. Cummings (Eds.), *The ethics and rhetoric of invasion ecology* (pp. 117–140). Lexington Books.
Selge, S., Fischer, A., & van der Wal, R. (2011). Public and professional views on invasive non-native species - a qualitative social scientific investigation. *Biological Conservation*, *144*(12), 3089–3097. https://doi.org/10.1016/j.biocon.2011.09.014
Shackelford, N., Hobbs, R. J., Heller, N. E., Hallett, L. M., & Seastedt, T. R. (2013). Finding the middle-ground: The native/non-native debate. *Biological Conservation*, *158*, 55–62. https://doi.org/10.1016/j.biocon.2012.08.020
Shackleton, R. T., Larson, B. M. H., Novoa, A., Richardson, D. M., & Kull, C. A. (2019c). The human and social dimensions of invasion science and management. *Journal of Environmental Management*, *229*, 1–9. https://doi.org/10.1016/j.jenvman.2018.08.041
Shackleton, R. T., Richardson, D. M., Shackleton, C. M., Bennett, B., Crowley, S. L., Dehnen-Schmutz, K., Estévez, R. A., Fischer, A., Kueffer, C., Kull, C. A., Marchante, E., Novoa, A., Potgieter, L. J., Vaas, J., Vaz, A. S., & Larson, B. M. H. (2019b). Explaining people's perceptions of invasive alien species: A conceptual framework. *Journal of Environmental Management*, *229*, 10–26. https://doi.org/10.1016/j.jenvman.2018.04.045
Shackleton, R. T., Shackleton, C. M., & Kull, C. A. (2019a). The role of invasive alien species in shaping local livelihoods and human well-being: A review. *Journal of Environmental Management*, *229*, 145–157. https://doi.org/10.1016/j.jenvman.2018.05.007
Shirley, P. (2019). Nature's place - what should live where? *ECOS,40*(3), 1–10.
Silliman, B., & Wear, S. (2018). Conservation bias: What have we learned? *In*. In P. Kareiva, M. Marvier, & B. Silliman (Eds.), *Effective conservation science: Data not dogma* (pp. 181–185). Oxford University Press.
Simberloff, D. (2003). Confronting introduced species: A form of xenophobia? *Biological Invasions*, *5* (3), 179–192. https://doi.org/10.1023/A:1026164419010
Simberloff, D. (2005). Non-native species DO threaten the natural environment! *Journal of Agricultural & Environmental Ethics*, *18*(6), 595–607. https://doi.org/10.1007/s10806-005-2851-0
Simberloff, D. (2011a). Non-natives: 141 scientists object. *Nature*, *475*(7354), 36. https://doi.org/10.1038/475036a
Simberloff, D. (2011b). The rise of modern invasion biology and American attitudes towards introduced species. In I. D. Rotherham & R. A. Lambert (Eds.), *Invasive and introduced plants*

and animals: Human perceptions, attitudes and approaches to management (pp. 121–136). Earthscan.

Simberloff, D. (2012). Nature, natives, nativism, and management: Worldviews underlying controversies in invasion biology. *Environmental Ethics*, *34*(1), 5–25. https://doi.org/10.5840/enviroethics20123413

Simberloff, D. (2013). *Invasive species: What everyone needs to know*. Oxford University Press.

Simberloff, D. (2015). Nature's nature and the place of non-native species. *Current Biology*, *25*(14), 588–591. https://doi.org/10.1016/j.cub.2015.06.008

Simberloff, D., Barney, J. N., Mack, R. N., Carlton, J. T., Reaser, J. K., Stewart, B. S., Tabor, G., Lane, E. M., Hyatt, W., Malcom, J. W., Buchanan, L., & Meyerson, L. A. (2020). U.S. action lowers barriers to invasive species. *Science*, *367*(6478), 636. https://doi.org/10.1126/science.aba7186

Simberloff, D., Martin, J.-L., Genovesi, P., Maris, V., Wardle, D. A., Aronson, J., Courchamp, F., Galil, B., García-Berthou, E., Pascal, M., Pyšek, P., Sousa, R., Tabacchi, E., & Vilà, M. (2013). Impacts of biological invasions: What's what and the way forward. *Trends in Ecology & Evolution*, *28*(1), 58–66. https://doi.org/10.1016/j.tree.2012.07.013

Simberloff, D., & Vitule, J. R. S. (2014). A call for an end to calls for the end of invasion biology. *Oikos*, *123*(4), 408–413. https://doi.org/10.1111/j.1600-0706.2013.01228.x

Sinclair, R., & Pringle, A. (2017). Guests, pests or terrorists? Speciesed ethics and the colonial intelligibility of 'invasive' others. In J. Stanescu & K. Cummings (Eds.), *The ethics and rhetoric of invasion ecology* (pp. 31–60). Lexington Books.

Slobodkin, L. B. (2001). The good, the bad and the reified. *Evolutionary Ecology Research*, *3*, 1–13.

Smith, N. (2011). Blood and soil: Nature, native and nation in the Australian imaginary. *Journal of Australian Studies*, *35*(1), 1–18. https://doi.org/10.1080/14443058.2010.541475

Smout, T. C. (2003). The alien species in 20th-century Britain: Constructing a new vermin. *Landscape Research*, *28*(1), 11–20. https://doi.org/10.1080/01426390306527

Smout, T. C. (2011). How the concept of alien species emerged and developed in twentieth century Britain. In I. D. Rotherham & R. A. Lambert (Eds.), *Invasive and introduced plants and animals: Human perceptions, attitudes and approaches to management* (pp. 55–66). Earthscan.

Smout, T. C. (2014). What's natural: A species history of Scotland in the last 10,000 years. *The Glasgow Naturalist*, *26*(1), 11–16.

Soulé, M. (1990). The onslaught of alien species, and other challenges in the coming decades. *Conservation Biology*, *4*(3), 233–239. https://doi.org/10.1111/j.1523-1739.1990.tb00283.x

Srinivasan, K., & Kasturirangan, R. (2017). Conservation and invasive alien species: Violent love. In J. Maher, H. Pierpoint, & P. Beirne (Eds.), *The Palgrave international handbook of animal abuse studies* (pp. 433–452). Palgrave Macmillan.

Stanescu, J. (2017). Alien ecology, or, how to make ontological pluralism. In J. Stanescu & K. Cummings (Eds.), *The ethics and rhetoric of invasion ecology* (pp. 17–30). Lexington Books.

Stanescu, J., & Cummings, K. (2017b). When species invade. In J. Stanescu & K. Cummings (Eds.), *The ethics and rhetoric of invasion ecology* (pp. vii–xviii). Lexington Books.

Stanescu, J., & Cummings, K. (*eds*). (2017a). *The ethics and rhetoric of invasion ecology*. Lexington Books.

Steer, J. E. S. 2015. *The reconciliation of introduced species in New Zealand: Understandings from three 'exceptional' case studies*. Unpublished PhD Thesis, University of Auckland.

Subramaniam, B. (2001). The aliens have landed! Reflections on the rhetoric of biological invasions. *Meridians: Feminism, Race, Transnationalism*, *2*(1), 26–40. https://doi.org/10.1215/15366936-2.1.26

Subramaniam, B. (2017). Spectacles of belonging: (un)documentating citizenship in a multispecies world. In J. Stanescu & K. Cummings (Eds.), *The ethics and rhetoric of invasion ecology* (pp. 87–101). Lexington Books.

Switzer, D., & Angeli, N. F. (2016). Human and non-human migration: Understanding species introduction and translocation through migration ethics. *Environmental Values*, *25*(4), 443–463. https://doi.org/10.3197/096327116X14661540759232

Tassin, J., & Kull, C. (2015). Facing the broader dimensions of biological invasions. *Land Use Policy*, *42*, 165–169. https://doi.org/10.1016/j.landusepol.2014.07.014

Tassin, J., Thompson, K., Carroll, S. P., & Thomas, C. D. (2017). Determining whether the impacts of introduced species are negative cannot be based solely on science: A response to Russell and Blackburn. *Trends in Ecology & Evolution*, *32*(4), 230–231. https://doi.org/10.1016/j.tree.2017.02.001

Taylor, P. (2005). *Beyond conservation: A wildland strategy*. Earthscan.

Theodoropoulos, D. I. (2003). *Invasion biology: Critique of a pseudoscience*. Avvar Books.

Thomas, C. D., & Ohlemüller, R. (2010). Climate change and species' distributions: An alien future? In H. Perrings, M. Mooney, & M. Williamson (Eds.), *Bioinvasions and Globalization: Ecology, economics, management, and policy* (pp. 19–29). Oxford University Press.

Thomas, C. D. (2013). The Anthropocene could raise biological diversity. *Nature*, *502*(7469), 7. https://doi.org/10.1038/502007a

Thomas, C. D. (2017). *Inheritors of the earth: How nature is thriving in an age of extinction*. Allen Lane.

Thomas, C. D., & Palmer, G. (2015). Non-native plants add to the British flora without negative consequences for native diversity. *PNAS*, *112*(14), 4387–4392. https://doi.org/10.1073/pnas.1423995112

Thompson, K. (2014). *Where do camels belong? The story and science of invasive species*. Profile Books.

Trigger, D., Mulcock, J., Gaynor, A., & Toussaint, Y. (2008). Ecological restoration, cultural preferences and the negotiation of 'nativeness' in Australia. *Geoforum*, *39*(3), 1273–1283. https://doi.org/10.1016/j.geoforum.2007.05.010

Trudgill, S. (2001). Psychobiogeography: Meanings of nature and motivations for a democratized conservation ethic. *Journal of Biogeography*, *28*(6), 677–698. https://doi.org/10.1046/j.1365-2699.2001.00593.x

Trudgill, S. (2008). A requiem for the British flora? Emotional biogeographies and environmental change. *Area*, *40*(1), 99–107.

Valéry, L., Fritz, H., & Lefeuvre, J.-C. (2013). Another call for the end of invasion biology. *Oikos*, *122*(8), 1143–1146. https://doi.org/10.1111/j.1600-0706.2013.00445.x

Van der Wal, R., Fischer, A., Selge, S., & Larson, B. M. H. (2015). Neither the public nor experts judge species primarily on their origins. *Environmental Conservation*, *42*(4), 349–355. https://doi.org/10.1017/S0376892915000053

Van Dooren, T. (2011). Invasive species in penguin worlds: An ethical taxonomy of killing for conservation. *Conservation and Society*, *9*(4), 286–298. https://doi.org/10.4103/0972-4923.92140

van Eeden, L. M., Newsome, T. M., Crowther, M. S., Dickman, C. R., & Bruskotter, J. (2020). Diverse public perceptions of species' status and management align with conflicting conservation frameworks. *Biological Conservation*, *242*, 108416. https://doi.org/10.1016/j.biocon.2020.108416

Velland, M. (2018). Are local losses of biodiversity causing degraded ecosystem function? In P. Kareiva, M. Marvier, & B. Silliman (Eds.), *Effective conservation science: Data not dogma* (pp. 27–31). Oxford University Press.

Verbrugge, L. N. H., Leuven, R. S. E. W., & Zwart, H. A. E. (2016). Metaphors in invasion biology: Implications for risk assessment and management of non-native species. *Ethics, Policy and Environment*, *19*(3), 273–284. https://doi.org/10.1080/21550085.2016.1226234

Verbrugge, L. N. H., Van den Born, R. J. G., & Lenders, H. J. R. (2013). Exploring public perception of non-native species from a visions of nature perspective. *Environmental Management*, *52*(6), 1562–1573. https://doi.org/10.1007/s00267-013-0170-1

Vimercati, G., Kumschick, S., Probert, A. F., Volery, L., & Bacher, S. (2020). The importance of assessing positive and beneficial impacts of alien species. *NeoBiota*, *62*, 525–545. https://doi.org/10.3897/neobiota.62.52793

Vince, G. (2011). Embracing invasives. *Science*, *331*(6023), 1383–1384. https://doi.org/10.1126/science.331.6023.1383

Vogel, S. (2016). *Thinking like a mall: Environmental philosophy after the end of nature*. MIT Press.

Wallach, A. D., Bekoff, M., Batavia, C., Nelson, M. P., & Ramp, D. (2018). Summoning compassion to address the challenges of conservation. *Conservation Biology*, *32*(6), 1255–1265. https://doi.org/10.1111/cobi.13126

Warren, C. R. (2007). Perspectives on the 'Alien' versus 'Native' Species Debate: A critique of concepts, language and practice. *Progress in Human Geography*, *31*(4), 427–446. https://doi.org/10.1177/0309132507079499

Warren, C. R. (2008). Alien concepts: A response to Richardson. *Et Al. Progress in Human Geography*, *32*(2), 299–300. https://doi.org/10.1177/0309132507088314

Warren, C. R. (2009). Using the native/alien classification for description not prescription: A response to Christopher Preston. *Progress in Human Geography*, *33*(5), 711–713. https://doi.org/10.1177/0309132509343376

Warren, C. R. (2011). Nativeness and nationhood: What species 'belong' in post-devolution Scotland? In I. D. Rotherham & R. A. Lambert (Eds.), *Invasive and introduced plants and animals: Human perceptions, attitudes and approaches to management* (pp. 67–79). Earthscan.

Warren, R. J., II, King, J. R., Tarsa, C., Haas, B., & Henderson, J. (2017). A systematic review of context bias in invasion biology. *PLoS ONE*, *12*(8), e0182502. https://doi.org/10.1371/journal.pone.0182502

Webber, B. L., & Scott, J. K. (2012). Rapid global change: Implications for defining natives and aliens. *Global Ecology and Biogeography*, *21*(3), 305–311. https://doi.org/10.1111/j.1466-8238.2011.00684.x

Whatmore, S. (2002). *Hybrid geographies: Natures, cultures, spaces*. Sage.

Willis, K. J., & Birks, H. J. B. (2006). What is natural? The need for a long-term perspective in biodiversity conservation. *Science*, *314*(5803), 1261–1265. https://doi.org/10.1126/science.1122667

Wilson, J. R. U., García-Díaz, P., Cassey, P., Richardson, D. M., Pyšek, P., & Blackburn, T. M. (2016). Biological invasions and natural colonisations are different - the need for invasion science. *NeoBiota*, *31*, 87–98. https://doi.org/10.3897/neobiota.31.9185

Woods, M., & Moriarty, P. V. (2001). Strangers in a strange land: The problem of exotic species. *Environmental Values*, *10*(2), 163–191. https://doi.org/10.3197/096327101129340796

Young, A. M., & Larson, B. M. H. (2011). Clarifying debates in invasion biology: A survey of invasion biologists. *Environmental Research*, *111*(7), 893–898. https://doi.org/10.1016/j.envres.2011.06.006